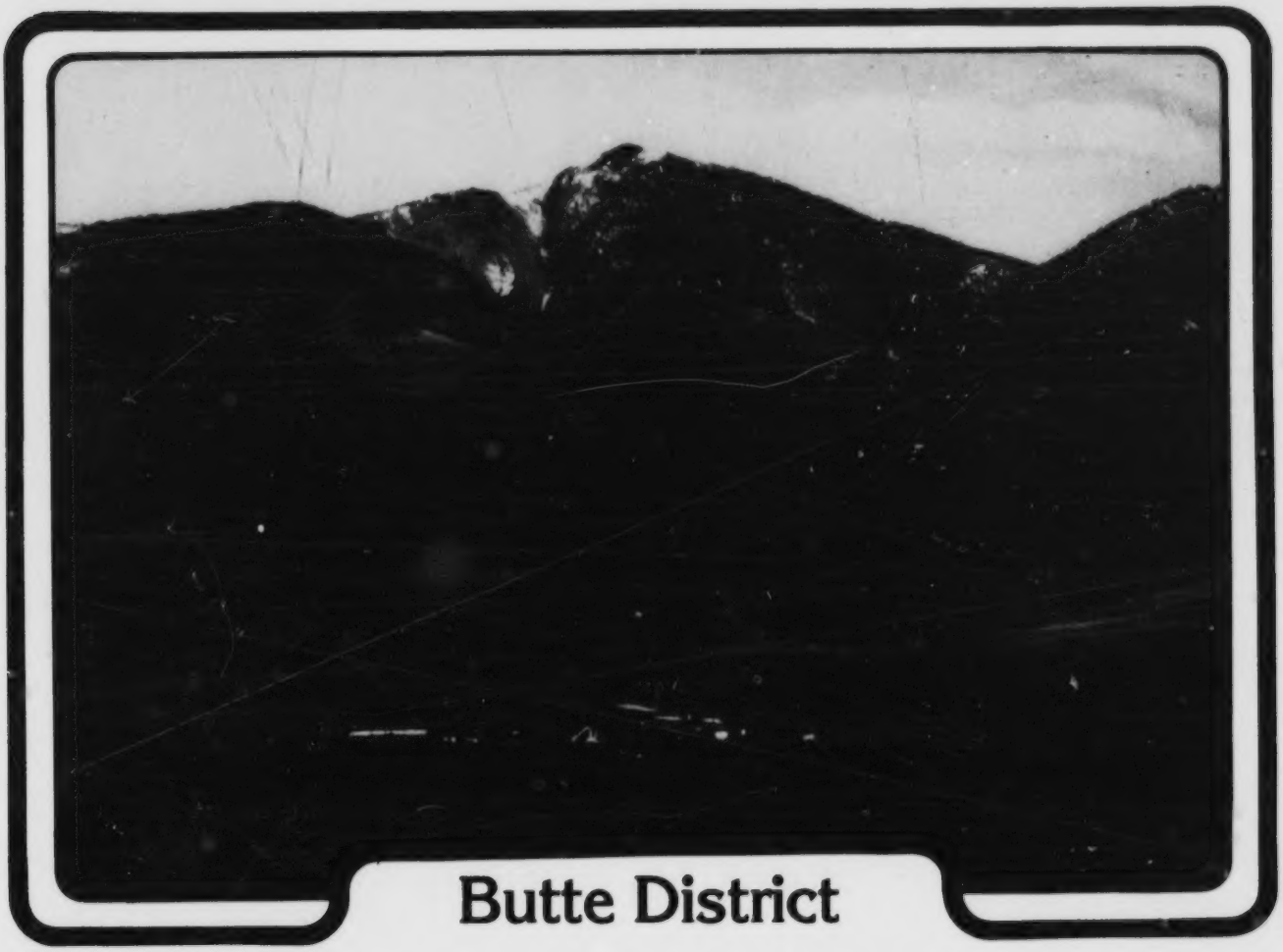
B 98

OIL AND GAS

ENVIRONMENTAL ASSESSMENT OF BLM LEASING PROGRAM



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UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

1981

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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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IN REPLY REFER TO

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
District Office
P.O. Box 3388
Butte, Montana 59702

Dear Reader:

This environmental assessment describes the effects of oil and gas leasing in the Bureau of Land Management's Butte District. It also specifies the mitigating measures necessary to reduce undesirable environmental consequences.

A district-wide assessment of this type cannot address every possible circumstance, nor can it deal with site-specific details. However, as the document explains, site-specific assessments are made for each lease before oil and gas exploration can proceed on federal lands.

We invite your comments regarding this environmental assessment. They should be mailed to

Bureau of Land Management
Butte District Office
P.O. Box 3388
Butte, Montana 59702

Sincerely yours,

Jack A. McIntosh
District Manager

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Jack A. McIntosh
District Manager

ENVIRONMENTAL ASSESSMENT FOR OIL AND GAS LEASING PROGRAM

Butte District

Bureau of Land Management

United States Department of the Interior

September 1981

SUMMARY

Oil and gas activity in the Butte District is low, but development could occur over most of the district. Almost the entire district is within the Overthrust Belt. With more than 70 percent of the federal mineral rights under lease, it is likely that wildcat drilling will increase and that production could occur in the next five to ten years.

A wide diversity of landforms, vegetation, and resources makes the assessment of impacts and possible mitigation difficult. The major potential impacts would be to watershed and wildlife values. Examples are erosion caused by surface-disturbing activities and disruption of wildlife, particularly when animals are concentrated on winter range.

An area of high gas potential along the Rocky Mountain Front coincides with essential habitat for the grizzly bear, a threatened species. We recommend thorough interagency coordination for this area, along with all normal mitigating measures. Major emphasis would be placed on assessing cumulative impacts and initiating wildlife monitoring in key areas before and during any activity.

This assessment recommends a checklist approach at the point of leasing. This will ensure that site-specific resource values are considered in the leasing decision and in the development of stipulations to mitigate impacts. Decisions made in current land use plans will be considered, as will the cumulative impacts of activities. Individual assessments are required for each specific surface-disturbing proposal; these assessments allow for proper mitigation or denial of each proposal. These measures, coupled with an adequate program of compliance and consultation with state agencies and other federal agencies, will minimize environmental impacts.

Protection for threatened and endangered species, visual and watershed values, and cultural resources are standard on all leases. Additional stipulations can be added to restrict activities seasonally or in specific areas so that important resource values can be protected. Major emphasis will be placed on using all available techniques to properly reclaim all disturbed areas.

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ABBREVIATIONS, ACRONYMS, AND SPECIAL TERMS

APD	Application for permit to drill
BLM	Bureau of Land Management, U.S. Department of the Interior
The Bureau	Bureau of Land Management, U.S. Department of the Interior
DSL	Montana Department of State Lands
EPA	U.S. Environmental Protection Agency
FLPMA	Federal Land Policy and Management Act of 1976
GS	Geological Survey, U.S. Department of the Interior
KGS	Known geological structures (areas known to contain producible oil and gas deposits)
MDFWP	Montana Department of Fish, Wildlife, and Parks
MFP	Management framework plan (a BLM land use planning document)
MSO	Montana State Office, BLM
NEPA	National Environmental Policy Act of 1969
ORV	Off-road vehicle
RMOGA	Rocky Mountain Oil and Gas Association
The Secretary	The United States Secretary of the Interior
SPCC	Spill prevention control and countermeasure
T&E	Threatened and endangered species of animals or plants
USDA	U.S. Department of Agriculture. The Forest Service and the Soil Conservation Service are among the agencies managed by this department.
USFWS	U.S. Fish and Wildlife Service, Department of the Interior
VRM	Visual resource management (a program to protect scenic values and reduce the visual impact of development activities)
WPRS	Water and Power Resources Service, U.S. Department of the Interior. A May 1981 decision restored this agency's previous name, Bureau of Reclamation, under which it operated from 1923 to 1979.

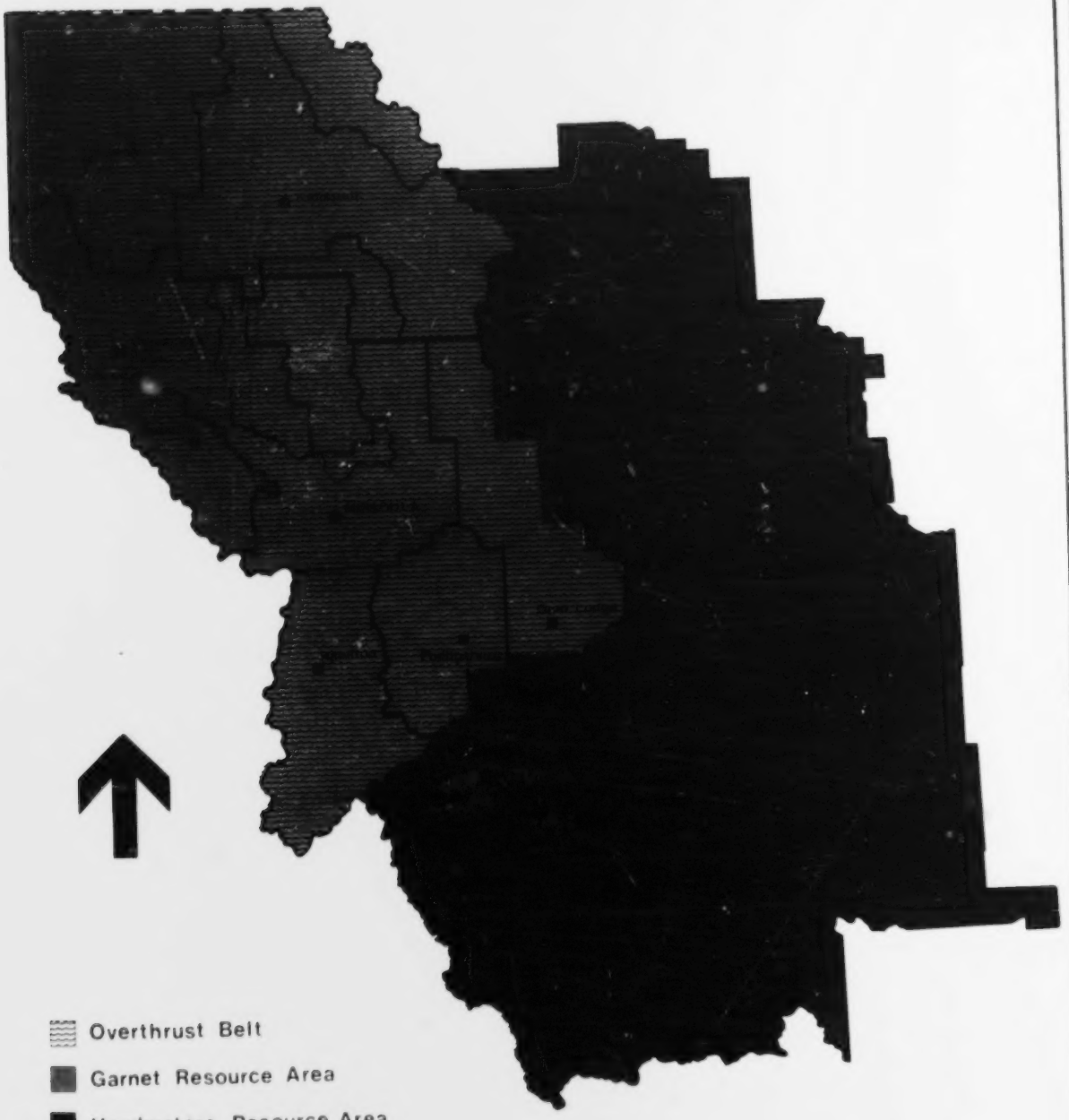
INTRODUCTION

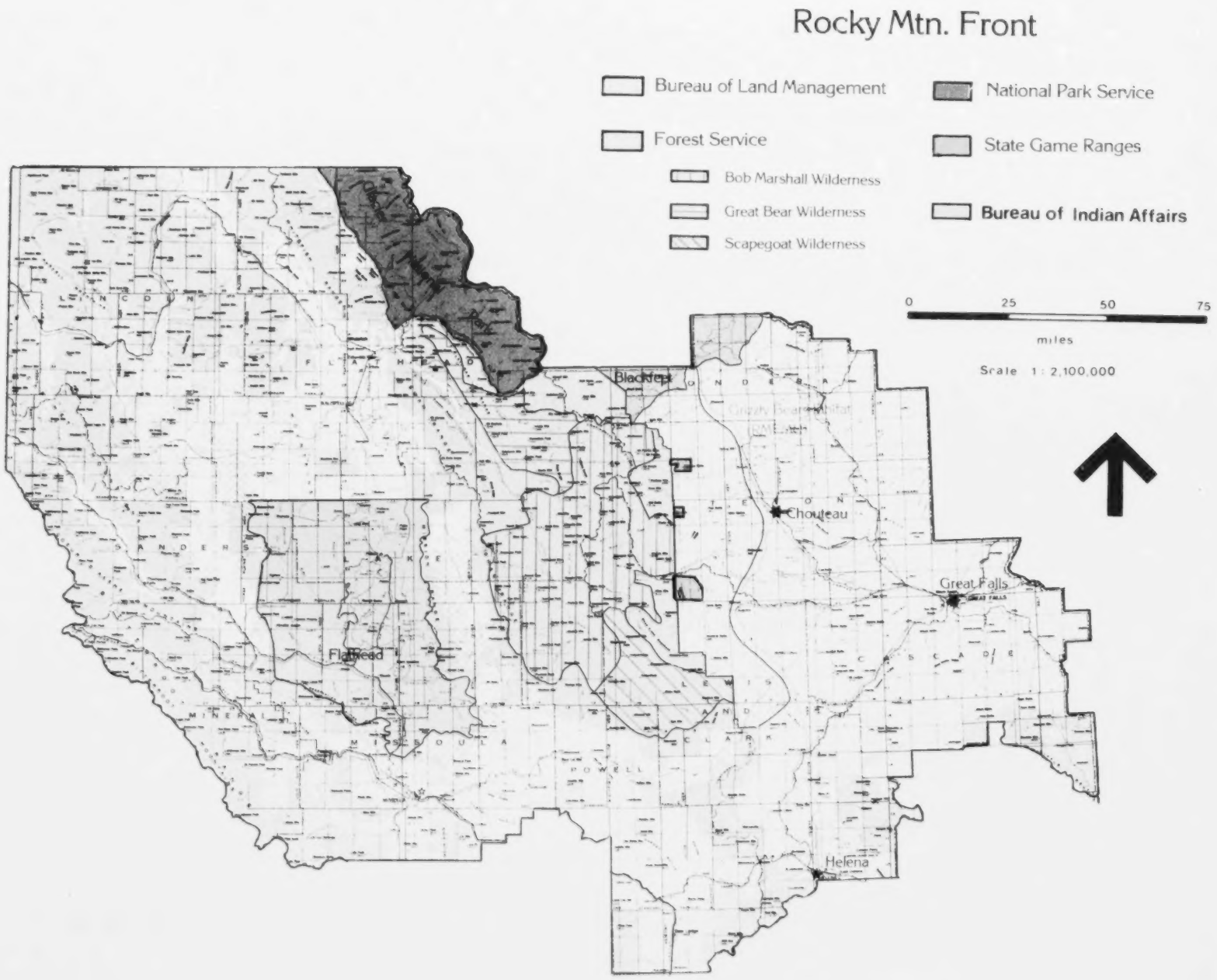
This assessment, which has been prepared pursuant to section 102(2)(c) of the National Environmental Policy Act of 1969, as amended, is designed to assess the impacts and recommend mitigating measures for federal oil and gas leasing within the Butte District of the Bureau of Land Management. Chapter 1, the Proposed Action, pertains to oil and gas activities in Montana, North Dakota, and South Dakota. It provides an overview of oil and gas operations and of the general oil and gas situation in this three-state area. The rest of the assessment focuses on specific environmental considerations concerning oil and gas activities within the Butte District. The Location map shows the Butte District boundaries.

The Butte District comprises approximately 2.5 million acres of federal mineral ownership administered by the BLM. On one million acres of the total, the surface is privately owned or state owned. Approximately 70 percent of the mineral ownership (1.7 million acres) is currently leased for oil and gas. This assessment will guide decisions on new leases, reissuance of expired leases, and all surface-disturbing activities connected with oil and gas exploration and development.

Most of the Butte District is within the Overthrust Belt, which is receiving increasing attention as a top prospect for exploratory drilling. Recent drilling in the Rocky Mountain Front area northwest of Choteau has resulted in some production of gas and oil (see the Rocky Mountain Front map). These successes are expected to increase oil and gas activity in the next five years, as are changes in the energy relationship of the United States and Canada and other national and international factors.

PACIFIC OCEAN
WASHINGTON
OREGON
CALIFORNIA
NEVADA
IDAHO
MONTANA
N DAKOTA
S DAKOTA
WYOMING
NEBRASKA
COLORADO
UTAH
KANSAS
OKLAHOMA
ARIZONA
NEW MEXICO
TEXAS
Overthrust Belt
Butte District (BLM)


Overthrust Belt
Garnet Resource Area
Headwaters Resource Area
Dillon Resource Area


Rocky Mtn. Front
Bureau of Land Management
Forest Service
Bob Marshall Wilderness
Great Bear Wilderness
Scapegoat Wilderness
National Park Service
State Game Ranges
Bureau of Indian Affairs
0
25
50
75
miles
Scale 1: 2,100,000
Blackfeet
Chouteau
Great Falls
Flathead
Helena

CHAPTER 1 PROPOSED ACTION

CHAPTER 1

The Proposed Action is the continuation of BLM's oil and gas leasing program in Montana and the Dakotas in order to make federally administered oil and gas resources available to the region and nation.

This assessment, an integral part of BLM's leasing program, is designed to provide the foundation and framework for the utilization of environmental considerations required in the course of issuing oil and gas leases in the three-state area by the BLM. It identifies environmental factors requiring protection and attaches appropriate stipulations on oil and gas activity to insure that protective measures are implemented.

The objectives of the BLM oil and gas leasing program are: (a) continuation of federal oil and gas leasing with appropriate environmental protection in areas where oil and gas development is environmentally acceptable; and (b) identification of areas which, regardless of the stipulations, are not suitable to oil and gas leasing due to environmental considerations.

The analysis required to meet these objectives will allow BLM to stratify leasing decisions according to environmental sensitivity. This stratification provides a basis for continued leasing associated with meeting the objectives of the National Environmental Policy Act of 1969 as amended and BLM's Federal Land Policy and Management Act of 1976. In practice, a lease application for a given area will be reviewed concerning (1) the impact causing actions discussed in this chapter and (2) the area's sensitivity to these impact causing actions. These considerations will be the basis for a decision to either lease the area with appropriate stipulations which would effectively protect the resource(s) or not to lease because of extremely sensitive features in the area which cannot be protected with the existing range of stipulations.

Scope

The proposed action includes all practices by the BLM and the U.S. Geological Survey (GS) in issuing and administering oil and gas leases over the approximately 50 million subsurface acres under the management of the BLM in the three-state area.

Although the BLM is responsible for the leasing of federal oil and gas under Forest Service surface, this assessment will not attempt to study environmental impacts on those lands. Instead, the BLM will refer to site-specific environmental assessment and recommendations made by the Forest Service concerning oil and gas development on land it administers. It should be noted that the BLM and Forest Service coordinate closely in these matters based upon a 1978 cooperative agreement between the two agencies. This agreement encourages coordination in order to make both agencies aware of respective roles and responsibilities concerning environmental assessment. It also insures that the analytical approach and data bases used by both agencies are compatible and will facilitate reviews and recommendations between the two agencies.

In addition to its subsurface jurisdiction, the BLM currently administers approximately 8.4 million surface acres in the three-state area. The surface and subsurface acreage administered by the BLM in each state are shown in Figure 1-1.

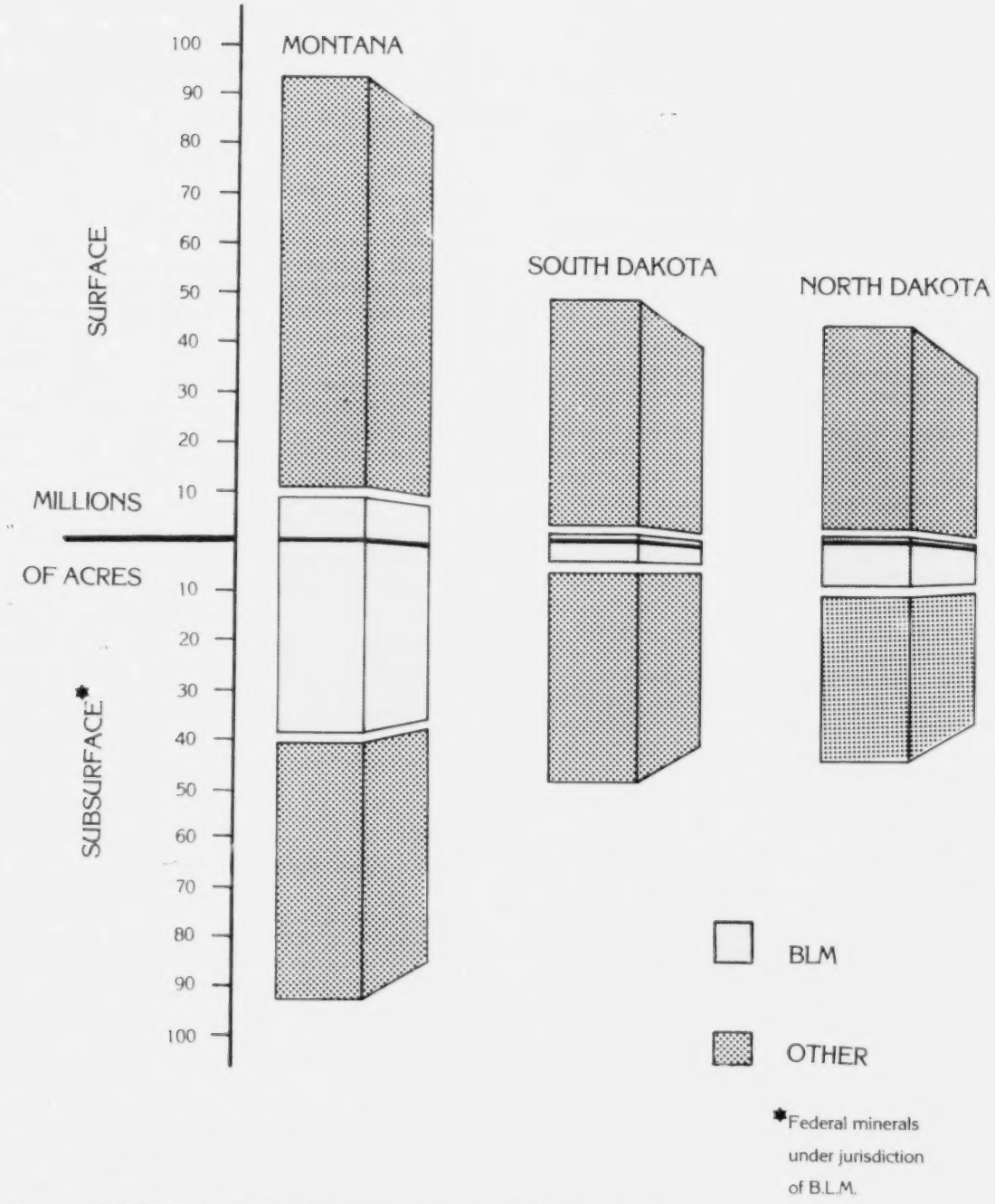
It is expected that this document can be used to assess environmental impacts from oil and gas development upon lands administered by the following agencies with surface management jurisdiction in Montana, North Dakota, and South Dakota in cases where these acreages overlie federal oil and gas subsurface:

Agency	Surface Acres
USDA—National Forest System Lands	
Region 1	18,102,368
Region 2	1,766,372
USDA—Agricultural Research Service	71,700
General Services Administration	714
USDI—Bureau of Reclamation	284,018
DOD—U.S. Air Force	8,916
DOD—U.S. Army	18,136
DOD—Corps of Engineers	607,678

In instances where the surface management agency has prepared its own site-specific analysis, this assessment will be available for reference with respect to likely environmental impacts.

Figure 1-1

SURFACE AND SUBSURFACE ACREAGE



Source: B.L.M. In Montana, U. S. Department of the Interior, 1977 and Geologist, Branch of Lands and Minerals, MSO.

1.1 ENERGY BACKGROUND

The United States has experienced significant changes in its political and economic well-being as a result of its dependence upon inexpensive foreign supplies of energy. The Arab oil embargo of 1973 precipitated an energy "crisis" in the sense that cheap, seemingly unlimited supplies of petroleum were no longer available to the U.S. The subsequent quadrupling of crude oil prices in the period of a few months made this nation and other industrial powers aware of their dependency upon nations which hold large reserves of petroleum. Domestic oil and gas development, in conjunction with energy conservation, was encouraged in the U.S. and elsewhere with the aim of reducing dependency upon foreign energy supplies. This effort has become increasingly more important in light of recent oil price increases ($20.71 per barrel) from foreign sources and because the U.S. is currently importing approximately 50% of the oil it uses.

The United States, the world's leading energy consumer, has historically been highly dependent upon both natural gas and petroleum as energy sources. In 1975, natural gas and petroleum together comprised approximately 74% of the nation's energy diet (petroleum 45%, natural gas 29%). This is a significant increase over the 47% contribution of these two fuels in 1947. Although overall energy consumption in the U.S. grew at an average annual rate of 2.8% between the years 1947 and 1975, the continued growth in petroleum and natural gas consumption averaged 8.4% per year, or approximately three times the annual growth rate of total national energy consumption. Figure 1-2 shows the increase in total energy consumption from 1947 to 1975 and the growing role of petroleum and natural gas in satisfying this demand.

It is obvious that national energy consumption would grow during this period as the nation became more populated. However, per capita energy consumption in the U.S. increased by 46% from 1947 to 1975. This means that, on the average, every individual in the U.S. in 1975 consumed approximately one and one-half times as much energy per day as in 1947. The increased growth in petroleum consumption in the United States has been made possible, to a great extent, by importing oil, and more recently liquefied petroleum gas, from other countries. Energy forecasts indicate that national consumption will continue to outstrip domestic production at least through the year 1990 (Figure 1-3).

Many areas of the world have supplied the United States' petroleum consumption during the last decade. In 1979 the U.S. was relying upon the Organization of Petroleum Exporting Countries (OPEC) for 72% of its annual oil imports (Figure 1-4). Forecasts of liquid hydrocarbon and natural gas supply through the year 2000 indicate a growth in imports of both fuels in order to keep pace with national consumption (Figure 1-5 and 1-6).

There exist many opportunities for energy conservation without a reduction in living standards in a nation which, with 6% of the world's population, accounts for approximately 34% of the earth's annual energy consumption. This rate of energy consumption is far greater than in many other modern societies with similar standards of living.

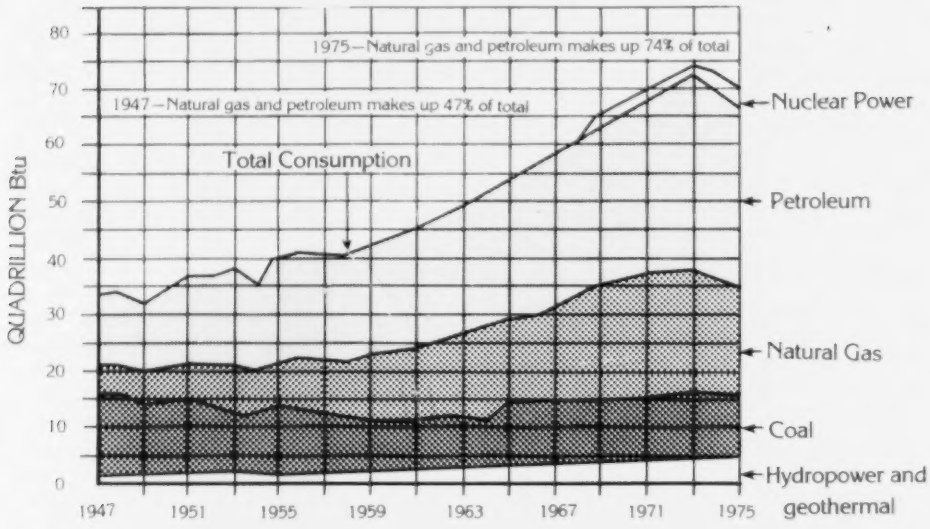
As part of a national program sponsored by the U.S. Department of Energy, Montana, North Dakota, and South Dakota have begun implementation of state energy conservation programs designed to reduce energy consumption by 5% to 6% from projected levels by the year 1985. These state programs embrace many aspects of energy conservation such as home weatherization, industrial, commercial, and residential lighting standards, thermal efficiency standards, carpooling, and the energy conservation education, to mention a few. It is likely that these programs will receive increasing attention as it becomes more apparent that energy conservation is an effective way to improve the nation's economic well-being while reducing our unnecessary dependence on foreign supplies of energy.

The oil and gas industry in Montana, North Dakota, and South Dakota is significant nationally. In 1976, Montana ranked 13th in crude oil production, with 1.1% of the nation's total, and 17th in natural gas production, producing 0.2% of the total. North and South Dakota ranked 17th and 30th, respectively, in oil production, and 19th and 50th in natural gas production. North Dakota supplied 0.9% of the nation's total crude oil production, and 0.1% of the gas production. South Dakota produced .01% of the nation's oil output, and currently has negligible natural gas production. Oil and gas activity in the study area is influenced by national trends; consequently, activity has increased with the nation's growing need for petroleum products.

Drilling activity fluctuates, but has generally been on the increase in the three-state area. As of December 1977, there were 3,330 producing oil wells in Montana, 69 wells in South Dakota, and 2,200 wells in North Dakota. Figure 1-7 shows total annual drilling activity in the three-state area from 1966 to 1977. Even though drilling activity has not changed significantly between 1966 and 1977, the actual annual production of oil and gas in Montana, North Dakota, and South Dakota decreased during the period 1967 to 1976 (Figure 1-8). Oil production decreased by 9% and gas production decreased by 8% during this period. Figure 1-9 shows that the proportion of total oil and gas production attributable to public subsurface in the three-state area is two to three times that for the nation.

Figure 1-2

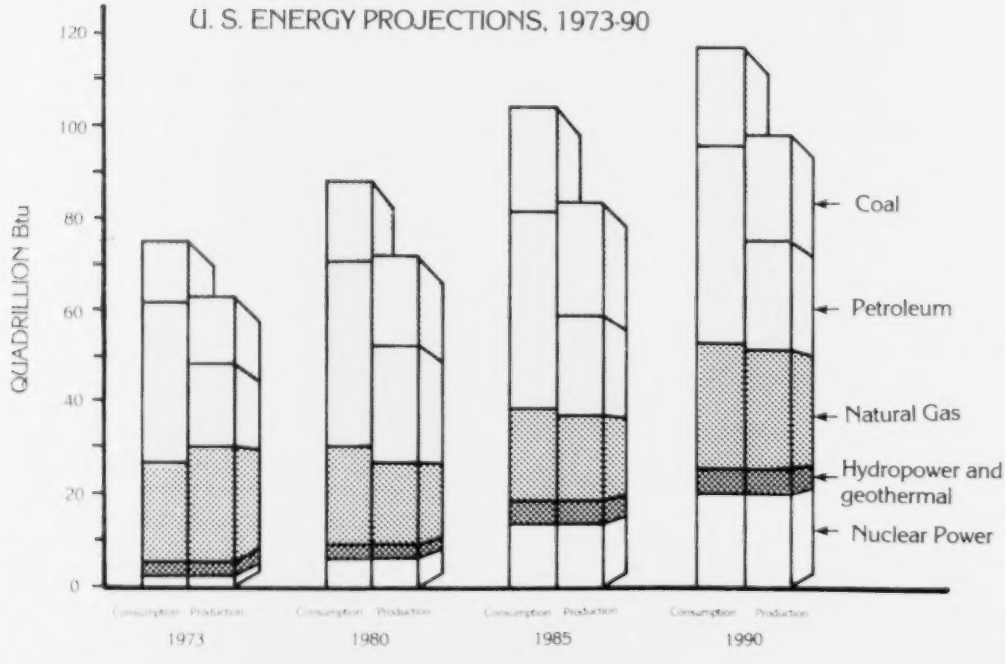
TOTAL U. S. ENERGY CONSUMPTION



Source: Energy Perspective 2, U. S. Department of the Interior, 1976

Figure 1-3

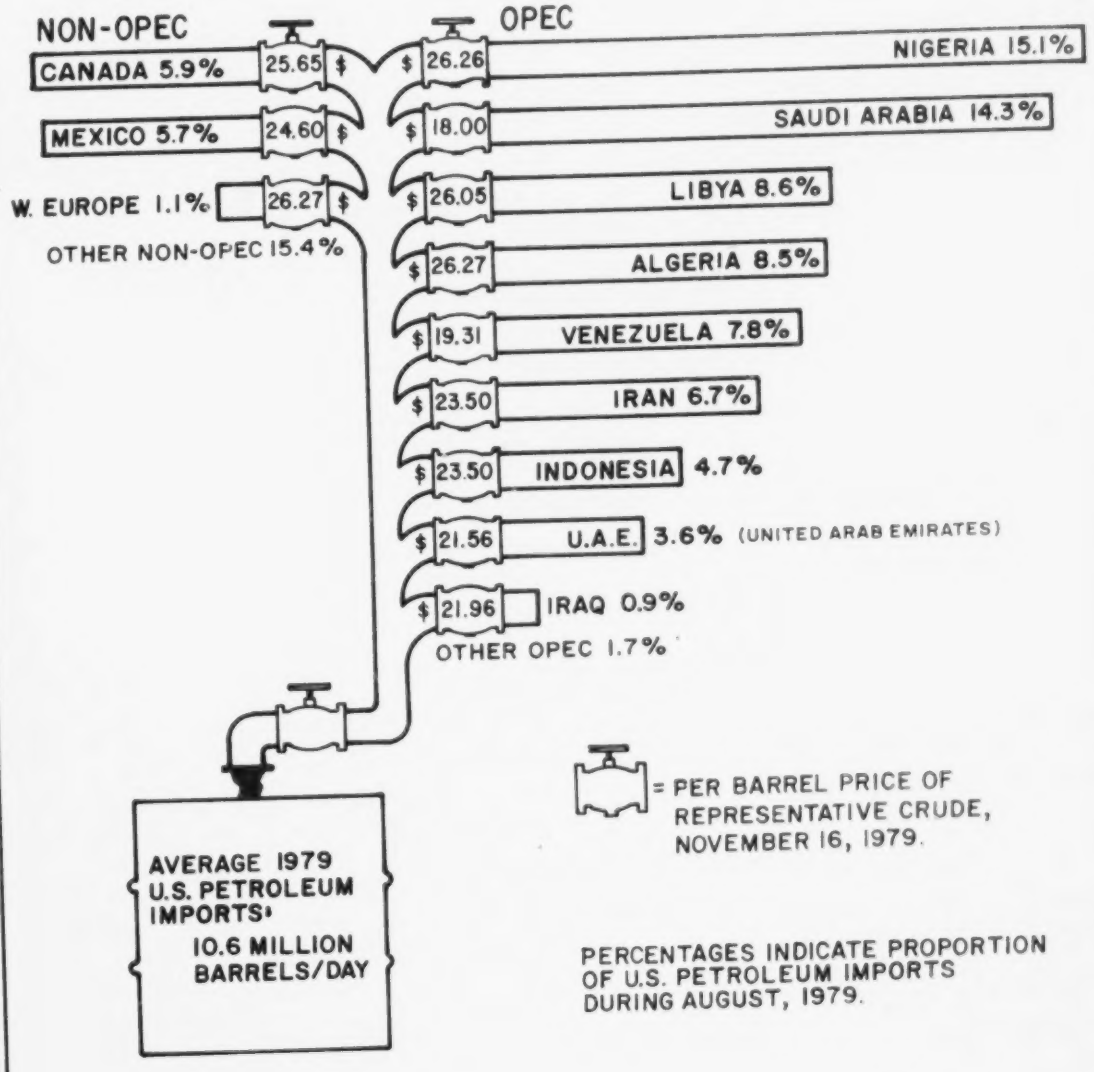
U. S. ENERGY PROJECTIONS, 1973-90



Source: Energy Perspective 2, U. S. Department of the Interior, 1976

FIGURE 1-4

SOURCES OF U.S. PETROLEUM IMPORTS*

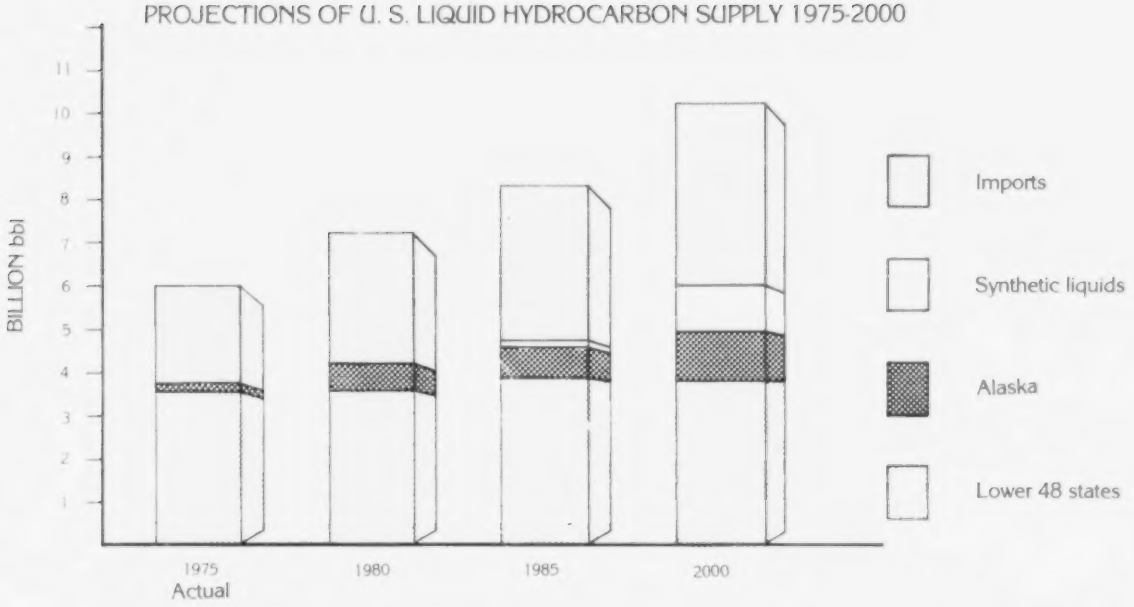


*DIRECT IMPORTS ONLY

SOURCES: AMERICAN PETROLEUM INSTITUTE, PETROLEUM INTELLIGENCE WEEKLY AND THE PETROLEUM SITUATION, 1979.

Figure 1-5

PROJECTIONS OF U. S. LIQUID HYDROCARBON SUPPLY 1975-2000

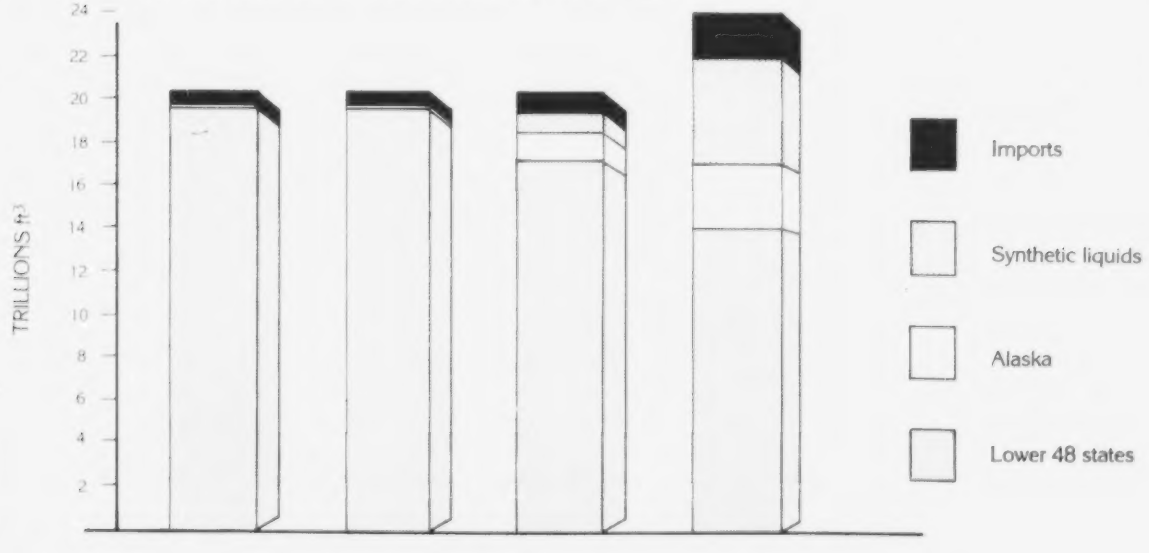


Source: Energy Perspective 2, U. S. Department of the Interior, 1976

Note U. S. Bureau of Mines estimates

Figure 1-6

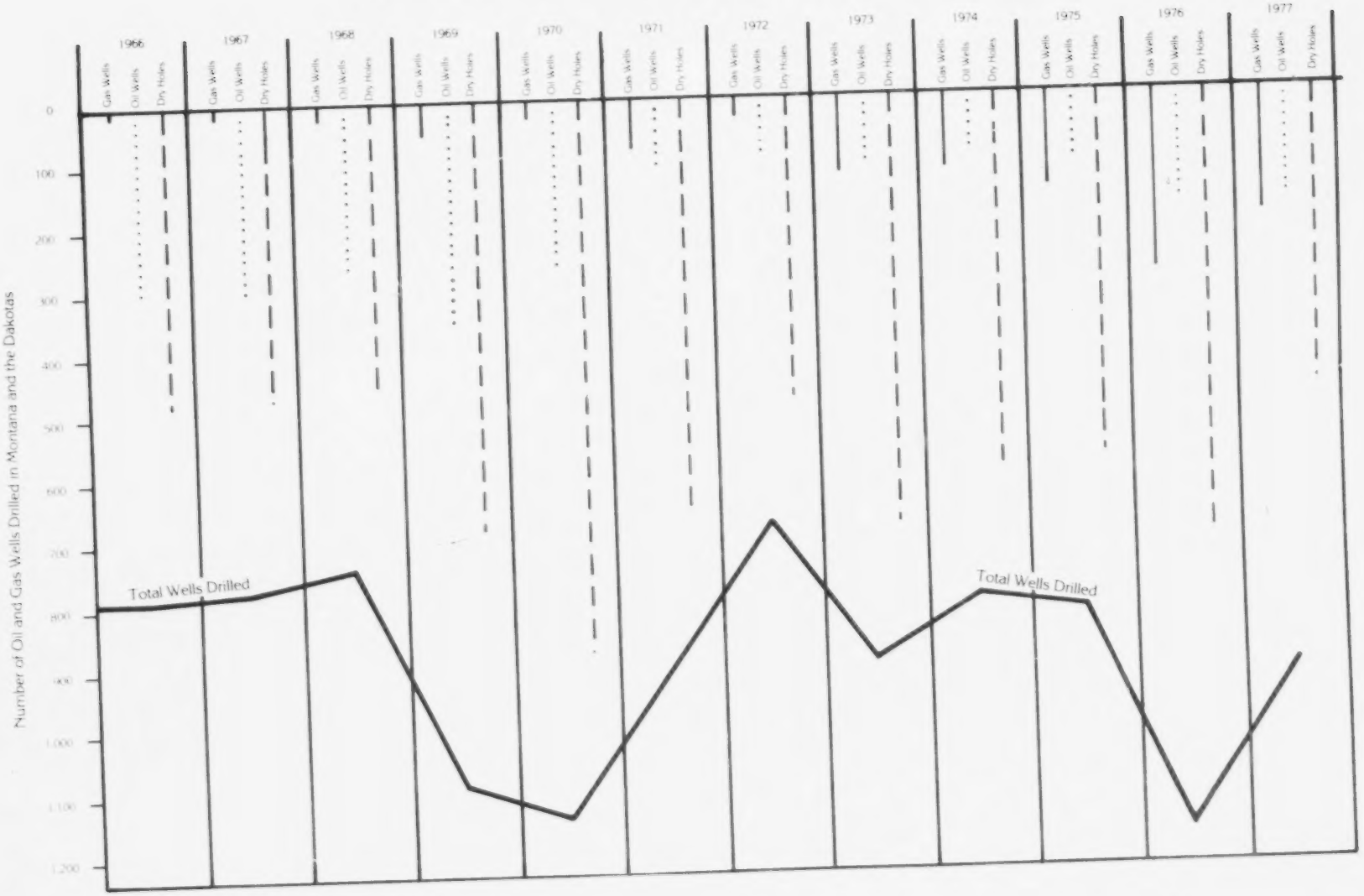
PROJECTIONS OF U.S. GAS SUPPLY, 1975 - 2000



Source: Energy Perspectives 2, U.S. Department of the Interior, 1976. Note U. S. Bureau of Mines estimates

Figure 1-7

TOTAL WELL DRILLING ACTIVITY IN THREE STATE AREA

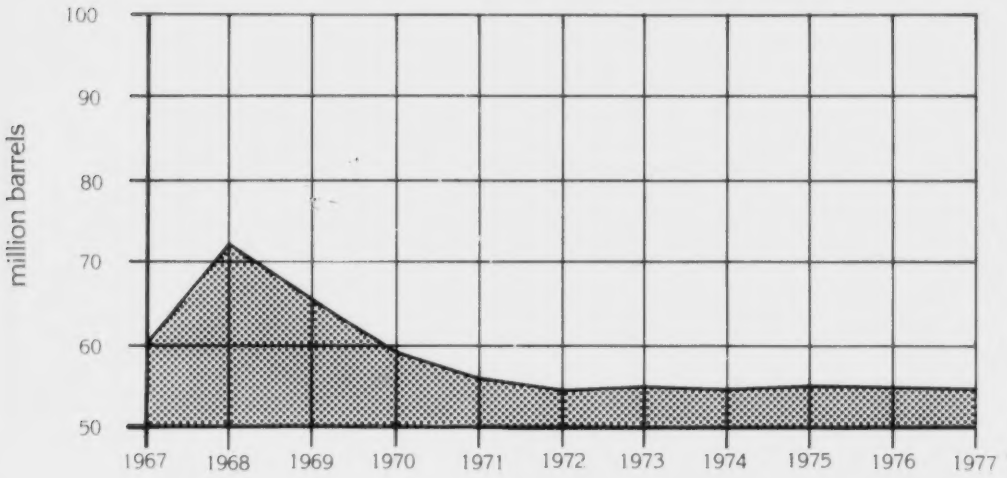


Source: Independent Petroleum Association of America

Figure 1 - 8

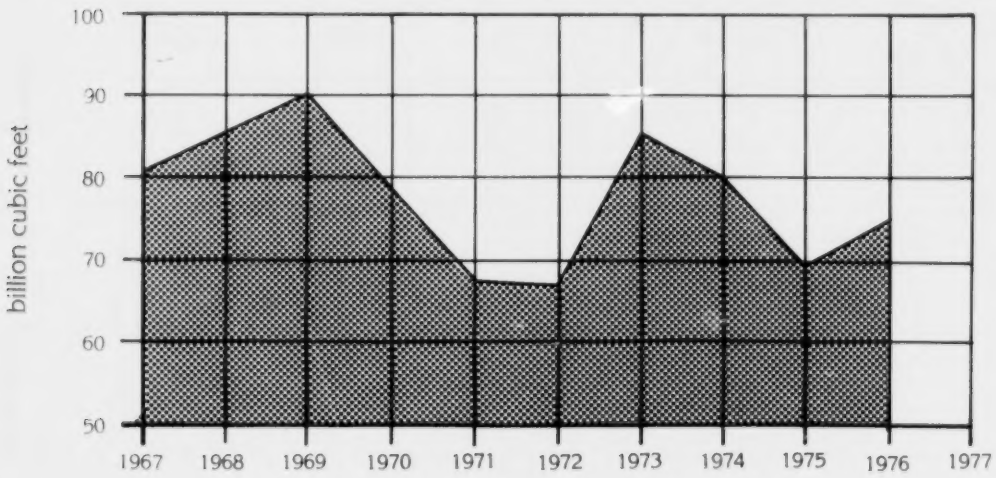
CRUDE OIL PRODUCTION

Montana North Dakota South Dakota



NATURAL GAS PRODUCTION

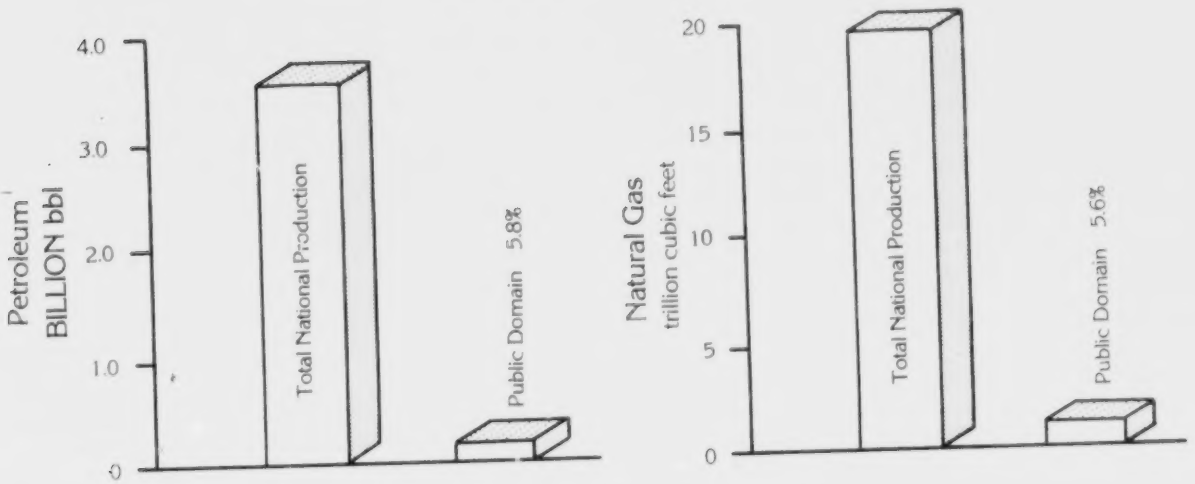
MONTANA, NORTH DAKOTA, SOUTH DAKOTA



Source U.S. Department of Energy

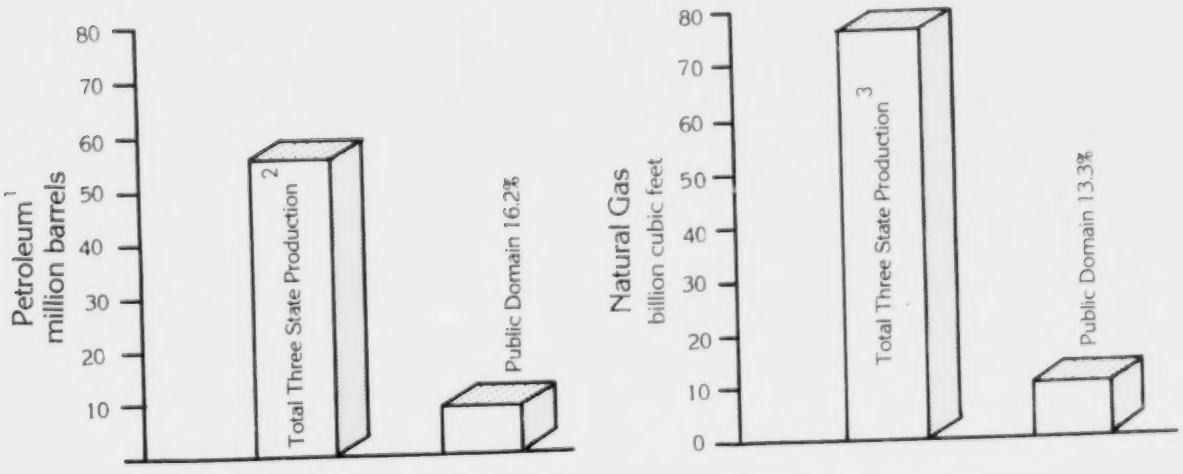
Figure 1-9

U.S. FOSSIL FUEL PRODUCTION — 1976



FOSSIL FUEL PRODUCTION — 1976

MONTANA NORTH DAKOTA SOUTH DAKOTA



Source: M.S.O. Geologist, Branch of Lands and Minerals.

[1] Includes crude oil and the heavier natural gas liquids.

[2] Represents approximately 1.6% of total national production.

[3] Represents approximately 0.4% of total national production.

1.2 SUMMARY DESCRIPTION OF LEASING PROCESS

Oil and gas leases fall into two basic categories—competitive and noncompetitive. Competitive leases are issued in Known Geological Structures (KGS) which are areas known to contain producible oil and gas deposits. Noncompetitive leases are issued for land outside KGSs and are available as a result either of open over-the-counter offers or simultaneous filings.

KGS land may be offered for competitive leasing based on response to public request or Bureau initiative. If this occurs, the GS then prepares a report as to KGS status, recommends whether competitive leasing is in the public interest, and groups tracts into lease parcels. If leasing is recommended, land nominated by the public is combined with other GS nominations (in active KGS areas), and a competitive lease sale is scheduled after the BLM district office is consulted concerning conflicts with land use planning. The BLM offers the tracts for lease through competitive sealed bids. The adequacy of the high bids tendered is determined by a bid evaluation team composed of representatives from the GS and BLM. Each sealed bid must be accompanied by an initial payment of 20% of the bonus offered; the remaining bonus payment must be paid prior to lease issuance.

On noncompetitive (over-the-counter) leases, the applicant files an offer to lease on lands open to lease in non-KGS areas. If, through adjudication, the lands are available for lease, the BLM district office or other appropriate surface management agency responds with appropriate land use recommendations and, upon approval, a ten year lease is issued to the applicant.

Previously leased parcels in non-KGS areas (i.e., simultaneous and noncompetitive filings) are listed monthly as they become available following expiration, cancellation, or termination of the old leases. Once a list of available tracts is approved and advertised, all applications received during the filing period are considered to have been filed simultaneously. An applicant may file only one application per tract accompanied by a $10 filing fee. A drawing is held and three applications are drawn for each tract. A lease is offered on the parcel in order in which they were drawn (i.e., a winner and two alternates).

If there are no simultaneous lease offers for a tract, it becomes available to the first over-the-counter applicant subsequent to the drawing.

All leases require rent payment in advance. Rent on noncompetitive leases is $1 an acre a year. Upon production of oil and gas, the minimum royalty charge is 12.5% of value. Prior to drilling, applicant must secure bond to insurance compliance with all terms of the lease. Rent and royalty schedules on competitive leases are described in the lease agreement.

1.3 MINERAL LEASING RESPONSIBILITIES OF BLM AND GS

The BLM and GS have joint responsibility to assure full compliance with the spirit and objectives of the National Environmental Policy Act (NEPA) of 1969, Federal Land Policy and Management Act of 1976, other federal environmental legislation, and supporting Executive Orders and regulations concerning oil and gas development. Prior to lease issuance, the Bureau has the prime responsibility in the exercise of the Secretary's discretionary authority whereas the GS has prime responsibility, with concurrence from BLM, relative to protection of the surface resources after the lease is issued. Generally, GS's responsibility is confined to the "area of operations." This area can be defined as that surface including and surrounding the drill pad necessary for the drilling, subsequent development, and possible production of the oil and/or gas wells(s) in a safe and reasonable manner.

As previously mentioned, the Bureau has prime responsibility prior to lease issuance. In the exercise of this responsibility, standard stipulations have been formulated, with GS cooperation, to cover most items necessary for the protection of and subsequent rehabilitation of the surface resources. If additional stipulations are required, these are formulated and included prior to lease issuance.

After lease issuance and prior to approval of any surface disturbing activities within the area of the lease, a detailed site-specific review and field examination is conducted by the GS and BLM or other surface administering agency. From this effort, site-specific requirements are formulated for the protection of the surface resources and subsequent rehabilitation, and imposed upon the lessee prior to approval of the proposed activity (i.e., geophysical work, well drilling). Although GS has prime responsibility at this point, they must have full concurrence from the surface managing agency. If differences exist, these are forwarded through various administrative levels and eventually to the Secretary.

1.4 FEDERAL, STATE, AND LOCAL ACTIONS

In order to better understand oil and gas leasing operations, the following discussion describes the responsibilities of the various governmental bodies in each phase of the operation.

Federal Actions

Exploration

There is no statutory authority for oil and gas exploration. Subpart 3045 of the Code of Federal Regulations (1970) established procedures to be followed in such operations.

Before geophysical operators conduct any operations on public lands, they are required to file a "Notice of Intent" with the District Manager, BLM.

The geophysical operator has a responsibility to cooperate and coordinate his operation with the District Manager. The operator's responsibilities are to:

- File a Notice of Intent on unleased lands, with maps showing proposed seismic lines and all necessary access routes before operations begin. The map should be a minimum scale of 1/2 inch to the mile.
- Be bonded.
- Notify the District Manager before he enters onto public lands.
- Obtain the District Manager's written approval for bulldozer or other dirt work.
- Notify the District Manager in writing of any changes in the original notice and secure written approval before proceeding.
- Comply with stipulations imposed by the District Manager at the pre-work conference and during field investigations.
- File a Notice of Completion.

The District Manager's responsibilities are to:

- Examine resource values and develop appropriate surface protection and reclamation measures.
- Conduct compliance inspections.
- Coordinate with the geophysical operator to explain the terms of the Notice of Intent, including operating practices to be followed or avoided, all relevant laws, and BLM administrative requirements.
- Complete final inspection after the Notice of Completion is filed. The inspection must determine that all instructions were complied with and all rehabilitation practices completed. A 90-day limit for the final inspection and notification of additional work is established by regulation. If further instructions are given to the operator at final inspection, an additional 90-day limit is established for the BLM after notification that the operator has completed his work.
- Release operator's bond.

A prospecting permit is required for geophysical work on Forest Service surface. This permitting process is similar to that used in BLM's Notice of Intent.

Operations

Once a federal lessee or designated operator indicates that he wishes to explore on or develop a lease, all proposed drilling operations and related surface disturbance activities must be approved before entry upon the lands involved. Approval will be in accordance with: (1) lease terms, including any additional lease stipulations; (2) Title 30 CFR Part 221, "Oil and Gas Operating Regulations," and (3) "Notice to Lessees No. 6" (NTL-6) issued by the GS effective June 1, 1976. The requirements that must be approved include the following:

Preliminary Review. A preliminary environmental review is required of all drilling proposals prior to entry on the ground to stake the location, access roads, and other surface-use areas. The operator must furnish a map of a scale not less than 1 inch equals 1 mile, that shows the preferred location and general topographic features, and explain the anticipated activity and surface disturbance to the District Engineer, GS, as well as the District Manager, BLM. This permits the district manager to identify any potential conflicts with other resource values. If conflicts are noted, a joint conference or field inspection is held involving USGS, BLM, and the operator.

Application for Permit to Drill. Prior to drilling or road construction on a federal lease, the operator must submit an Application for Permit to Drill (APD). The APD includes a Surface-Use and Operations Plan. Where private surface is involved, it should include a copy of the written agreement between the lessee or operator and the surface owner. A letter from the lessee or operator setting forth rehabilitation requirements agreed to with the surface owner is acceptable.

The APD provides operational and geologic information required by the GS. The Surface-Use and Operations Plan must allow assessment of the environmental effects expected from the proposed project. Bonding coverage must be obtained by the applicant before approval of the APD by GS.

GS sends this information to the BLM District Manager, who reviews the plan and recommends surface-protection stipulations for the approved permit. The BLM must decide at this time if it desires to obtain the well as a water well if oil or gas is not encountered in usable quantities.

Approval of Operations. Before repairing, deepening, or conditioning an existing well, a detailed written work plan must be submitted to GS.

In existing fields operators are required to submit, for GS approval, plans for new construction, reconstruction, or alteration of existing facilities, when additional surface disturbance will result.

Abandonment. Well abandonment requires prior approval by the GS and the BLM, which may require additional surface rehabilitation. These requirements

are normally part of the approved abandonment plan. Abandonment will not be approved until surface rehabilitation work required by the drilling permit or abandonment notice is complete, and required vegetation is established to the satisfaction of the BLM District Manager.

Water Well Conversion. If the BLM decides to acquire the well as a water well, it must assume responsibility at the time of abandonment. The operator will plug the well at the bottom of the desired fresh-water zone and leave casing in place. The operator then will begin surface cleanup as required. The BLM must reimburse the operator for casing and labor to complete the well.

Other Requirements

The Environmental Protection Agency has issued regulations affecting all oil and gas lessees and operators (Title 40 CFR, Part 112). These regulations require owners or operators to prepare Spill Prevention Control and Countermeasure (SPCC) Plans. EPA does not make special inspections to see that operators have SPCC Plans. They may call for one from an operator if they desire; if an operator does not provide one, he is subject to a fine. After a hazardous material spill, EPA usually calls for the operator's SPCC Plan.

Oil and gas operators must also meet requirements of the Department of Transportation and the Interstate Commerce Commission.

Table 1-1 summarizes the seven basic procedural steps necessary in obtaining a Permit to Drill for oil and gas on federal leases.

State Actions

If a well is productive, the state requires notification and a monthly report. A completion or recompletion report is also required. The Oil and Gas Conservation Commission in Montana, the Industrial Commission of North Dakota, and the South Dakota Board of Natural Resources are primarily interested in production and conservation of the oil and gas. Surface protection requirements are a matter between the surface owner and the operator. The State Commissioner of Public Lands issues state leases and also holds operator's bonds. He releases such bonds whenever the surface owner or lessee is satisfied. Monetary settlement is acceptable to the state in lieu of rehabilitation. If a well is a dry hole, operators are required to follow state procedures for plugging.

The above mentioned agencies have final authority on any well location variances. They also must approve unitization agreements. In addition, the states control water and gas injection systems, and underground gas-storage projects. The GS works with them on this, although the state has final authority.

Oil and gas operators are regulated by the State Department of Environmental Quality. This Department issues burning permits, if needed, as well as production-water discharge permits.

Local Actions

County governments are involved with oil and gas operators with respect to zoning, rights-of-way, and access.

The petroleum industry is very active in the study area. The headquarters of the Petroleum Association of Montana, located in Billings, is the state chapter of the Rocky Mountain Oil and Gas Association (RMOGA), headquartered in Denver. The major producers in the area belong to this association.

1.5 PHASES OF ONSHORE OIL AND GAS ACTIVITY

Normally, onshore oil and gas operations progress through five phases: (1) Preliminary exploration, (2) Exploratory drilling, (3) Development, (4) Production, and (5) Abandonment. Preliminary exploration can occur on leased or unleased lands. The remaining four phases occur on leased lands. Each phase has a potential for causing some type of disturbance to the environment. A brief description of the purpose for each phase and those actions within a phase that could cause some type of environmental disturbance follows.

Preliminary Exploration

A clue to the presence of oil and gas may be revealed by a search for geological structures within the rock that may contain underground oil and gas "traps". Figure 1-10 shows typical structures that may contain oil or natural gas traps.

Surface maps and aerial photos help the geologist identify geologic structures. Additional data can be gathered by the use of aircraft. Low altitude reconnaissance flights, frequently at elevations of 100 to 500 feet, help identify rock outcrops that can be studied later on the ground. Higher altitude flights above 3,000 feet are often made to conduct photographic, geophysical magnetometer, and other sensing surveys.

On-the-ground geologic mapping, gravitational and magnetic prospecting may follow if the previous work shows promise of oil and gas traps or reservoirs. Figure 1-11 shows how the gravity methods works. Small trucks and jeeps with crews of several people can be used at this stage of subsurface data gathering, and off-road travel is likely.

TABLE 1-1
PROCEDURAL GUIDELINES FOR ACTIONS ASSOCIATED WITH OIL AND GAS DEVELOPMENT

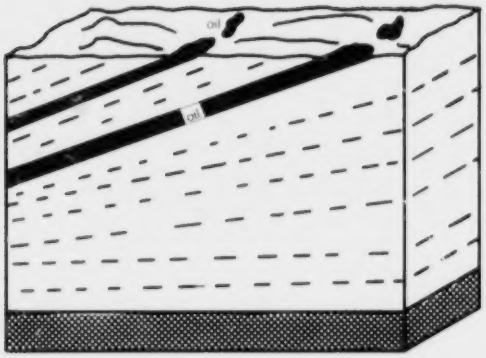
	Operator Action	Dept. of Interior Action	Field Activities	Normal Time Period
STEP I	1. Develops preliminary map and submits to GS and Bureau of Land Management 2. Identifies necessary off lease rights-of-way. 3. Attends joint field examination if requested by Interior.	1. Performs preliminary environmental review. 2. Reviews for other authorizations necessary. 3. Notifies operator if site conflicts with other resource values. Notifies operator if no archaeological survey is required. 4. Requests joint field examination if necessary.	1. Operator reviews on-the-ground site. 2. Joint field inspection, if necessary.	1. 15 days after receipt.
STEP II	1. Operator surveys well location and centerline of access roads. 2. Identifies necessary off lease rights-of-way. 3. Arranges for archaeological clearance work. 4. Develops Multi-point Surface Use & Operations Plan. Prepares Application for Permit to Drill. 5. Acquires private surface owner agreement if appropriate.		1. Survey and stake well site and other facilities, includes centerline staking of roads. 2. Archaeological survey performed.	1. Variable; contingent upon operator schedules.
STEP III	1. Operator files APD, Multi-point Surface Use & Operations Plan, private Surface Owner Agreement, and archaeological clearance. 2. Applies for necessary rights-of-way to Bureau of Land Management. 3. Attends joint field examination if requested by GS.	1. Reviews APD and Surface Use & Operations Plan. 2. Reviews archaeological survey. 3. Requests joint field examination, if appropriate. 4. Requests revision of plan if unacceptable. 5. Prepares necessary environmental analysis for APD and other federal actions required. 6. Prepares conditions of approval to APD and Multi-point Surface Use & Operations Plan. 7. APD approved or rejected. 8. Appropriate rights-of-way issued.	1. Joint field examination performed.	1. 30 days.
STEP IV	1. Performs in accordance with approval plan. 2. Files necessary reports to Geological Survey.	1. Compliance inspections.	1. Operator stakes well site exterior dimensions. 2. Operator begins construction and/or drilling activities. 3. Interior conducts compliance inspections.	1. Variable.
STEP V	1. Operator files Notice of Completion if well is a producer, plus modification to the Multi-point Surface Use & Operations Plan. Operator may need to arrange for additional archaeological survey on areas affected by plan modifications. 2. Operator files Notice of Intent to Abandon if well is dry hole. This can also be for a producer that has gone dry.	1. Reviews on-the-ground conditions for compliance and rehabilitation needs. 2. Reviews modifications to the Multi-point Surface Use & Operations Plan. 3. Requests joint field examination, if appropriate. 4. Requests revision of plan if unacceptable. 5. Prepares necessary environmental analysis for the plan and reviews archaeological survey. 6. Prepares conditions of approval to modified plan. 7. Plan approved or rejected. 8. Additional requirements for rehabilitation of disturbed areas developed for conditions of Intent to Abandon.	1. Joint field examination if necessary. 2. Field work performed to develop well and necessary 3. Field work performed to abandon well if this is the action. 4. Rehabilitation work begins on disturbed areas.	1. Review of plan, 30 days. 2. Rehabilitation work, one year.
STEP VI	1. Operator files Sundry Reports on a Well. Subsequent Report of Abandonment states all work is completed and ready for inspection.	1. Performs compliance checks to see that all conditions are met. 2. Approved final abandonment.	1. All work completed and ready for inspection.	1. Variable; one-two years for vegetation establishment.
STEP VII	1. Applies for release of the period of bond liability.	1. Performs final check, if necessary. 2. Approves release of the bond liability.	1. Possible field inspection by Bureau of Land Management.	1. 30 days.

SOURCE: Surface Operating Standards for Oil and Gas Exploration and Development, Second Edition 1978.

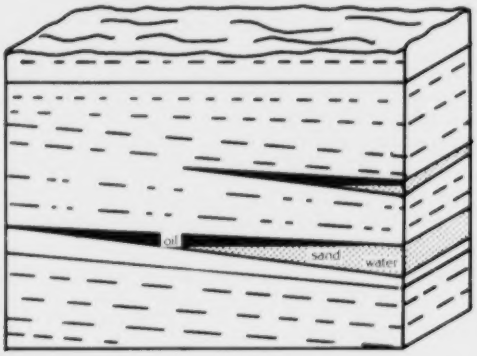
FIGURE 1-10

TYPICAL OIL AND GAS TRAPS

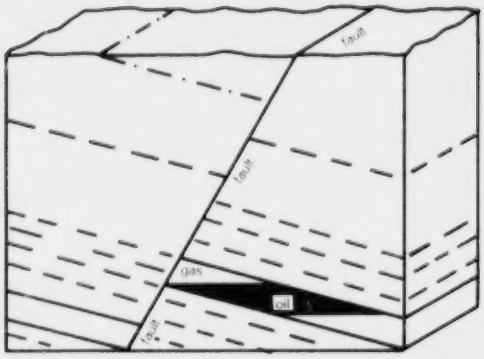
SEEPAGE



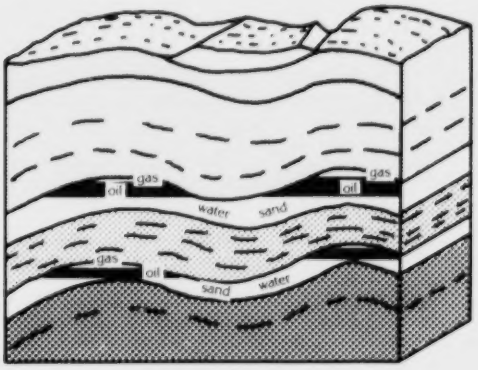
PINCH OUT



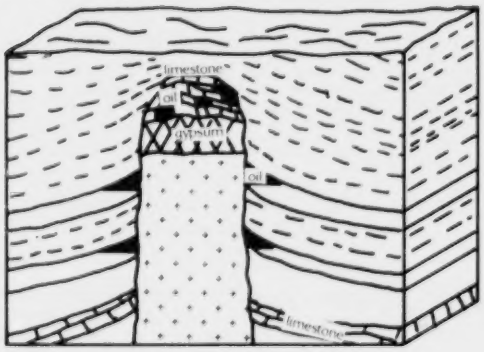
FAULT



ANTICLINE

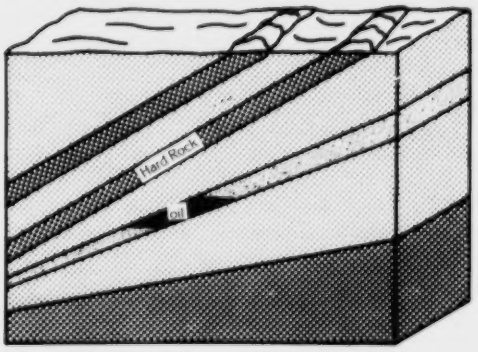


SALT DOME



Salt plug extends down to salt stratum, 30,000 to 40,000 ft.

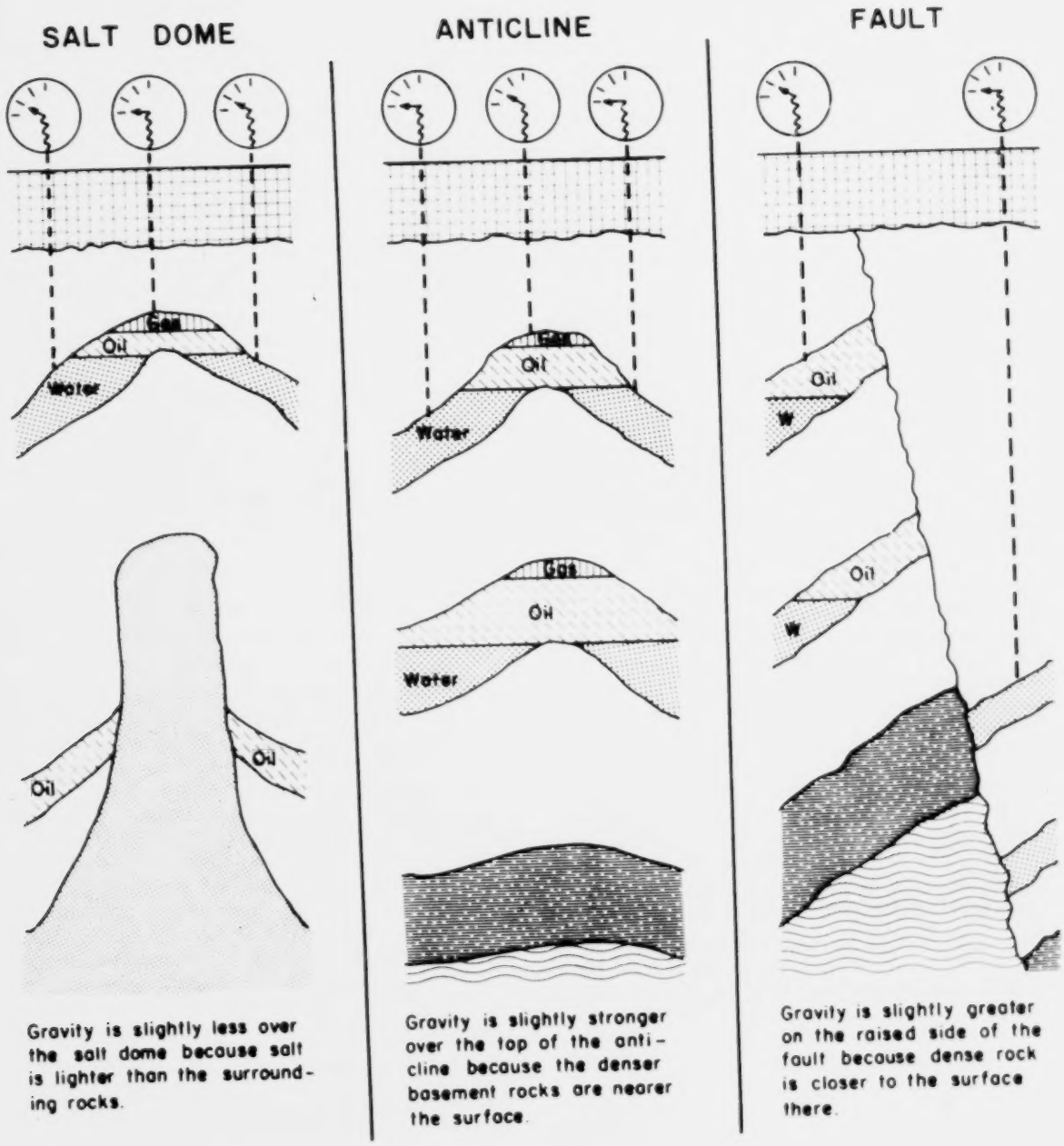
STRATIGRAPHIC TRAP



Source: U.S.D.I., Plain Facts about Oil, 1963. John Wiley and Sons, New York. 1960.

FIGURE 1–11

GRAVIMETER



Source: U. S. Department of the Interior, Plain Facts about Oil, 1963.

If the information gathered is still indicative of structures conducive for oil and gas reservoirs, seismic prospecting may follow. A seismic survey is a method of gathering subsurface geological information by recording impulses from an artifically generated shock wave. The common procedure used in reflection seismic surveys on land consists of creating a shock wave, and recording, as a function of time, the resultant seismic energy as it arrives at a group of vibration detectors (seismometers) arrayed on the ground surface. Portions of the seismic energy reach the seismometers by several different routes. One portion spreads over the ground as a surface wave. Another travels along a subsurface layer and is refracted to the surface. A third travels downward until it reaches an abrupt change in lithology of rock characteristics and is then reflected back to the surface (Figure 1-12).

Seismic methods are usually described by the various methods of generating the shock wave. Seismograph units mounted on trucks are used to detect shock waves in the earth generated by thumpers, vibrators, or explosives. Ground vibrations are made by thumpers by dropping a steel slab weighing about three tons to the ground several times in succession along a predetermined line. The weight is attached by chains to a crane on a special truck. A typical thumper unit is shown in Figure 1-13.

The vibrator method is widely used and is replacing the explosive method. Typically, four large trucks are used, each equipped with a vibrator mounted between the front and back wheels (Figure 1-14). The vibrator pads (about four feet square) are lowered to the ground and vibrators on all trucks are triggered electronically from the recorder truck. After the information is recorded, the trucks move forward a short distance and the process is repeated.

Explosives have been widely used in the past to generate the seismic impulse or shock wave. Traditionally, the explosive charge is detonated at the bottom of a drill hole of 200 feet or less. Recently, however, techniques of detonating the explosives on the surface have been developed that give good results in some areas.

Subsurface charges are usually placed at the bottom of a 4 to 6 inch hole drilled with a truck-mounted drill. Access suitable to allow the drill and recording trucks to travel across the surface is required. Detonation of the charge in some areas causes no surface disturbance while in other areas a small crater (up to 6 feet in diameter) is created (Figure 1-15). Cuttings from the well are normally hauled to a suitable disposal site, scattered by hand near the "shot hole," or disposed of in the hole. Bentonite mud is often used to plug the surface of the shot hole.

Where access limitations, topography, or other restraints prevent use of truck mounted drill rigs or recording trucks, lightweight portable equipment can be used. Various kinds of portble drills can be backpacked or delivered by aircraft to the area. These portable operations use a pattern of holes drilled to a depth of about 25 feet. All of these holes are loaded with explosives and detonated simultaneously.

Surface charges can be placed directly on the ground surface, on the surface of snow, or on a variety of stakes or platforms. Paper cones, survey stakes, lath, or 2 x 4's up to 8 feet in length have been used with varying success in different areas. Use of tall stakes or explosives placed on the surface of two feet or more of snow results in good seismic data in some areas, while creating no visible surface disturbance.

The vibrations or waves traveling through the ground are recorded by seismographic units some distance away at several locations. The seismic sensors and energy source are located along lines on a one to two-mile grid. Existing roads are used if possible. Lines may require clearing of vegetation and loose rock to improve access for the trucks. Each mile of line cleared to a width of 8-14 feet represents disturbance of about an acre of land.

In remote areas where there is little known subsurface data, a series of short seismic lines may be required to determine the regional dip and strike of subsurface formations. After this, seismic lines will be aligned with these formations to make seismic interpretation more accurate. Although alignment may be fairly critical, spacing of the lines can often be changed up to a quarter of a mile on a one-mile grid, before the results will affect the investigation program.

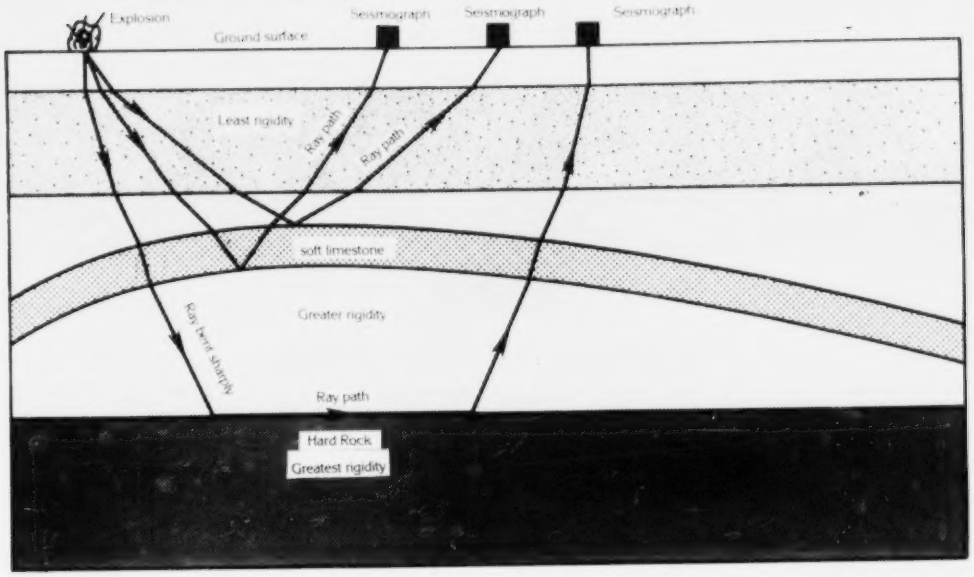
A network of low standard temporary roads and trails can result from this operation. Level topography with few trees and shrubs would require little or no road construction. An area with rugged topography and larger vegetative types such as trees and large shrubs would require more road preparations. Temporary roads and trails are usually constructed with bulldozers. The surface is cleared by removing vegetation and loose mineral material. Small streams and gullies are crossed by filling in the channel after placement of an appropriate culvert(s) or by dozing out the stream banks to provide a dip or gradual transition to enable equipment to cross. The alignment of these roads consists of straight lines, usually with little regard for gradient or steep slopes or rough terrain being traversed.

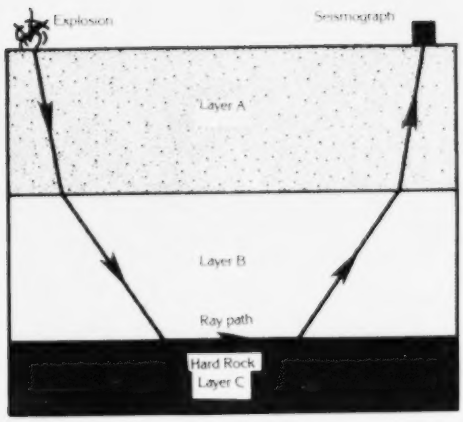
A typical seismic operation may use 10 to 15 men and five to seven trucks. Under normal conditions, three to five miles of line can be surveyed each day using the explosive method; five to ten miles are about average for a vibrator crew. The crews often work 70 to 80 hours a week in good weather.

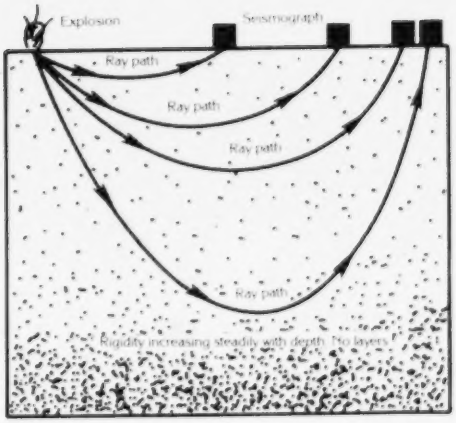
If preliminary investigation on BLM lands does not result in significant impacts on the surface, the operator need not notify the district BLM office. However, if the

FIGURE 1-12

SEISMOGRAPH

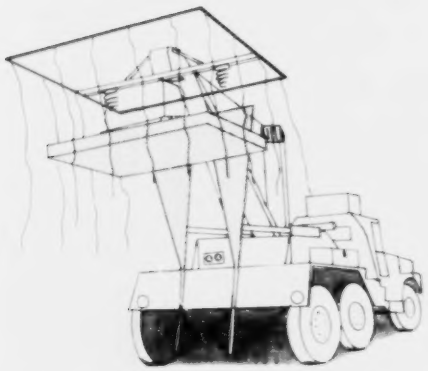






Source: U.S.D.I., Plain Facts about Oil, 1963. McGraw-Hill, Introduction to Geophysical Prospecting, 1960.

FIGURE 1–13
THUMPER



Thumper in action shows 6,000 pound steel slab, surrounded by safety chains to warn personnel, falling nine feet to strike earth and create shock waves. Weight-dropping aids the oil search as an effective economical substitute for dynamite in seismic operations.

Source: A Primer of Oilwell Drilling, University of Texas at Austin, 1976.

Figure 1-14: Vibrator Trucks during Seismic Operation

Figure 1-15: Shot Hole

Figure 1-16: Drill Rig

investigation will create noticeable impacts (e.g., road construction or ground clearing), as it could in seismograph prospecting, the operator must be properly bonded and must file a Notice of Intent. Bonds may be in the form of a rider on existing nationwide or statewide oil and gas bonds. BLM personnel will then examine resource values in the area and stipulate appropriate surface protection and reclamation requirements. The operator notifies the district manager before entry onto the land. It should be noted that the U.S. Forest Service requires a Prospecting Permit for virtually any oil and gas activity on lands it administers.

During preliminary investigation, the operator will comply with the stipulations for surface protection and reclamation. The BLM is responsible for checking this compliance. The operator notifies the district of any proposed changes in his activity. At the end of the investigation, the operator files a notice of completion, the BLM makes a final inspection, and, if all requirements have been met, the operator's bond is released.

Since no statutory authorization is required for entry on the land, avoidance of adverse impacts is dependent on the cooperation of oil and gas exploration operators. However, rehabilitation of damage can be required by the government.

Exploratory Drilling

Drilling does not begin until a lease has been acquired by the operator. In cases where preliminary investigations are favorable and warrant further exploration, exploratory drilling may be justified. Figure 1-16 shows a typical exploratory rig working in prairie country. More precise data on the geologic structure is obtained by stratigraphic tests using shallow drill holes.

Additional subsurface information revealing the nature of near surface structural features may be obtained by drilling holes to depths of 2,000 to 3,000 feet or deeper.

Drilling is accomplished primarily by rotary drill rigs. Rock chips and cuttings are brought to the surface from the bottom of the drill hole by high-pressure air flow or a flow of drilling mud. The chips and cuttings are collected, bagged, and identified as to depth of their origin. The chips are then examined to determine their composition and age, which helps to identify the formation and structure from which the chips originated. This kind of information will help the geologist find a marker zone or formation to correlate the previously obtained geologic and geophysical information to actual structures.

Temporary roads good enough to accommodate truck mounted drill rigs, water trucks, and other service equipment must be constructed. Where level, solid ground exists, little road construction is usually necessary. In hilly or mountainous areas, more road building would be necessary. Figure 1-17 shows an oil and gas access road in a mountainous area.

Figure 1-17: Road Built during Exploration

A space of about one-half acre or less is leveled and cleared of vegetation for the average drill site. If high pressure air is used to remove rock chips or rock cuttings, rock dust may be emitted to the air when samples are not being collected. If mud is used as a drilling fluid, mud pits may be excavated; more commonly, portable mud tanks are used. Usually, one to three days are required to drill the test holes.

Oil and gas are found in small spaces in porous rock somewhat like water in a sponge. It seeps slowly through the porous material until it is trapped by impervious rock, often appearing as a layer between water and gas. The preliminary exploration is done in an attempt to tentatively locate these traps. If preliminary exploration still indicates the possible existence of oil and gas, a "wildcat well" (i.e., a well drilled outside of a Known Geologic Structure) will be drilled into the suspected zone to determine if in fact the oil and/or gas are present and if its quality and quantity is adequate for profitable sale.

Nationally, approximately 1 out of every 16 wildcat wells produce significant amounts of oil or gas. Only 1 out of 140 wildcat wells produces enough to be financially successful. In recent years, success ratios for the three-state study area were considerably higher. During 1977, Montana's wildcat success rate was 25%, North Dakota's rate was 17%, and South Dakota's rate was 32%.

The depth of wildcat wells depends on the geology of an area. In the Williston Basin and Overthrust Belt areas, wells are commonly drilled to a depth of 10,000 feet or more. Drilling equipment could remain on this type of site for six months, while in other areas such as the northern part of Montana, shallower wells up to a few thousand feet are common and may be completed in a few weeks.

Prior to drilling, an area or drill pad must be cleared and leveled for drilling equipment. The well site, usually one to four acres, is cleared of all vegetation and graded nearly flat for the drilling rig, mud pumps, mud pit, generators, pipe rack, and tool house. Other facilities such as storage tanks for water and fuel are located nearby.

From 50,000 to 100,000 gallons of water a day may be needed for mixing drilling mud, cleaning equipment, cooling engines, etc. A surface pipeline may be laid to a stream or a water well, or the water may be trucked to the site.

A drilling rig may be moved from one site to the next after being dismantled. In some instances, rigs can be skidded short distances in level terrain which will shorten the tearing down and rigging up time. Moving a dismantled rig involves use of heavy trucking equipment for transportation and crews to erect the rig.

In order to move a drilling rig from one drill site to another, temporary roads with a capacity sufficient to haul the drill rig, well service equipment, and to accommodate continuous traffic to and from the drill site are built (Figure 1-18). Time of year, topography, and duration of drilling activity are other factors which influence how the road is constructed.

Figure 1-18: Temporary Road for Hauling Drilling Equipment

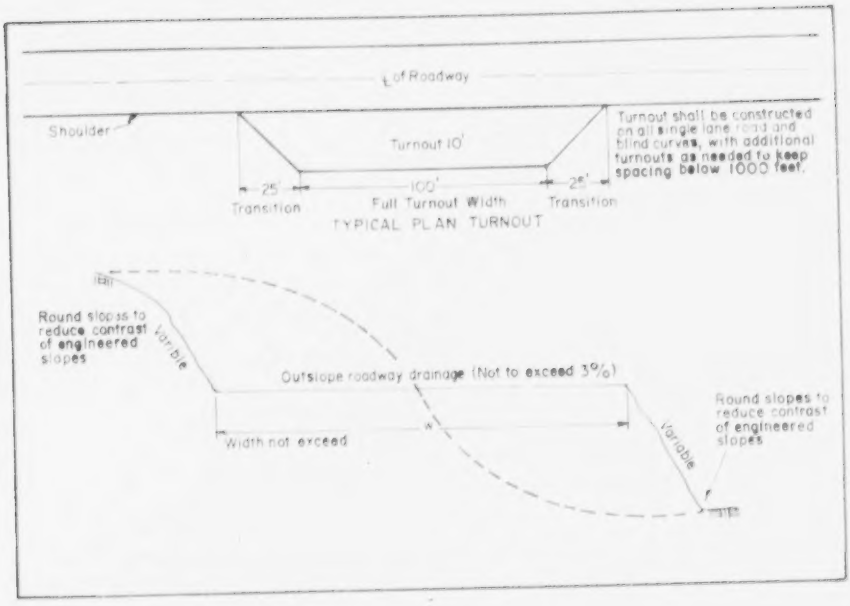
Typically, a temporary road would not exceed 16 feet in width. In general, temporary roads should be designed for the minimum width needed for the activity. Turnouts, as shown in Figure 1-19, are made on single lane roads, blind curves, and approximately every 1,000 feet along the road. In hilly or mountainous areas, it may be necessary to cut and fill slopes. Cut slopes up to 3:1 (three feet horizontal and one foot vertical) and fill slopes of 2:1 are common. Construction of a road 16 feet wide would require approximately 1.9 acres per mile of road.

A single lane road with a ten foot wide running surface would require about 1.5 acres of surface per mile, plus road cuts and fills. In hilly and mountainous areas, the surface areas required for a road would increase depending on the topography and the number of cuts and fills. Bulldozers, maintainers, and other types of heavy construction equipment would be needed to construct and maintain temporary wildcat well roads. A part of this activity would include necessary culvert installation, setting of timbers, etc.

Drilling is started by "spudding in" the well; that is, starting the hole. Oftentimes, a short piece—10 to 12 feet—of conductor pipe is forced into the ground. Conductor pipe may be cemented by hand, driven into place using a piledriver, or it may be cemented in a hole drilled in the usual manner. The initial drilling usually proceeds rapidly and generally the string of surface casing is set before harder, deeper formations are encountered. The surface casing is a long length of steel pipe which is cemented into the well to protect

FIGURE 1—19

TEMPORARY ROADS


℄ of Roadway
Shoulder
Turnout 10'
Turnout shall be constructed on all single lane road and blind curves, with additional turnouts as needed to keep spacing below 1000 feet.
25'
100'
25'
Transition
Full Turnout Width
Transition
TYPICAL PLAN TURNOUT
Round slopes to reduce contrast of engineered slopes
Variable
Outslope roadway drainage (Not to exceed 3%)
Width not exceed
Variable
Round slopes to reduce contrast of engineered slopes

against water or rock getting into the hole. It is smaller in diameter than the conductor pipe but large enough to allow subsequent lengths of casing to be set as the well is deepened. Also, surface casing provides for attachment of blowout preventers that are necessary in case a zone containing high-pressure gas, water, or oil is encountered. Without blowout protection, the contents of this zone could blow all the drilling mud out of the well (Figure 1-20).

During or at the completion of drilling, the well is logged. Logging involves the measuring of physical characteristics of the rock formations and associated fluids, with instruments lowered to the bottom of the well. As the equipment is raised to the surface, the instruments record various data from each formation of interest. After study of the well logs and drill stem test data, the geologist decides whether the well has encountered sufficient quantities of oil or gas in a pay zone to warrant completion of the well.

Completion requires installation of steel casing between the surface casing and the pay zone. The casing is selectively cemented, to provide stability and to protect specific zones, and then perforated adjacent to the suspected producing formation. If the formation produces oil or gas, the area is developed. If the formation does not produce, the well may either be extended to a greater depth or abandoned.

During 1977, 259 wildcat wells were drilled in the three-state study area. Other drilling activity was in known fields (KGSs).

Development

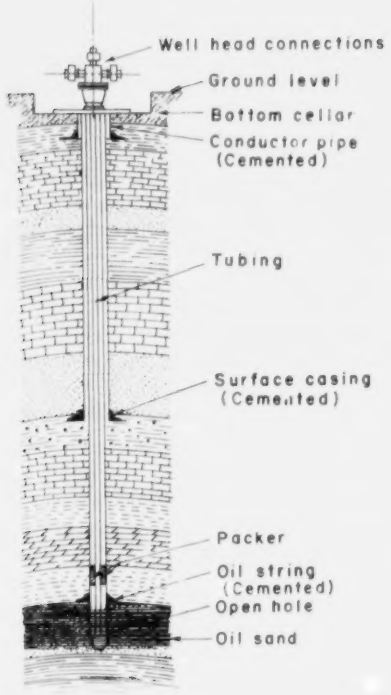
If a wildcat well becomes a "discovery" well (i.e., a well that yields commercial quantities of oil and gas), other wells are drilled to locate the boundaries of the field and to facilitate planning the best pattern of wells to drain the reservoir. As with wildcat wells, a field development will be staked and its exact location determined by surveyors, relative to land boundary lines and other geographic "fixes" tied into the geophysical surveys.

If the well is completed as a free-flowing well, the wellhead is simply closed off using a device known as a "Christmas tree" which consists of various valves and pressure regulators which are used to control oil or gas flow to facilities used in the production phase. If the well is a gas discovery, the operator is allowed to flare gas for a short period of time to determine capacity before shutting the well in or connecting the well to gas gathering pipelines.

Quite often, however, the producing zone will not have enough pressure to force the oil to the surface. In this situation, the oil must be pumped to the surface using "artificial lift" methods. When pump installation is

FIGURE 1–20

WELL CUTAWAY VIEW



Source: Primer of Oil & Gas Production, American Petroleum Institute, 1978.

complete, the well normally is tested for a period of days or months to determine whether the producing zone is adequate to support additional wells. More detailed seismic lines tying previous lines to the discovery well may be required. The discovery well may also be studied to draw upon previous seismic work and provide more accurate subsurface data.

A temporary well spacing pattern must be established before development drilling begins. Information considered in establishment of a spacing pattern includes data from the discovery well concerning porosity, permeability, pressure, composition, and depth of formations in the reservoir; well production rates and type (predominately oil, or predominately gas); and the economic effect of the proposed spacing on recovery.

Oil and gas well spacing, established by the state with concurrence from GS, can be from a few acres per well to a section or more. In general, well density for gas wells is much less than that for oil wells. Typically spacing restrictions require that gas wells be sited on 160 acres or more while oil wells can be sited on tracts of 40 acres or more. This implies that, generally, a maximum of 16 oil wells or 4 gas wells can be located on one section (640 acres) of land.

Surface use in an oil and gas field also may be affected by unitization of the leaseholds. In many areas containing federal lands, an exploratory unit is formed before a wildcat is drilled. The boundary of the unit is based on geologic data. The developers "unitize" the field by entering into an agreement to develop and operate it as a unit, without regard to separate ownerships. Costs and benefits are allocated according to agreed terms.

Unitization reduces the surface-use requirements because all wells are operated as though on a single lease. Duplication of field processing facilities is minimized, because development and operations are planned and conducted by a single unit operator. Unitization may also involve wider spacing than otherwise, resulting in fewer wells and roads.

The rate at which development wells are drilled depends on such factors as whether the field is on a lease basis or unitized, the probability of profitable production, the availability of drilling equipment, protective drilling requirements, and the degree to which limits of the field are known.

Once well spacing has been approved, the operator plans development of the lease. The procedures for drilling development wells are about the same as those for wildcat wells, except that there is usually less subsurface sampling, testing, and evaluation. Surface uses for development drilling may include access roads, well sites, flowlines, storage tank batteries, facilities to separate oil, gas, and water, and injection wells for saltwater disposal.

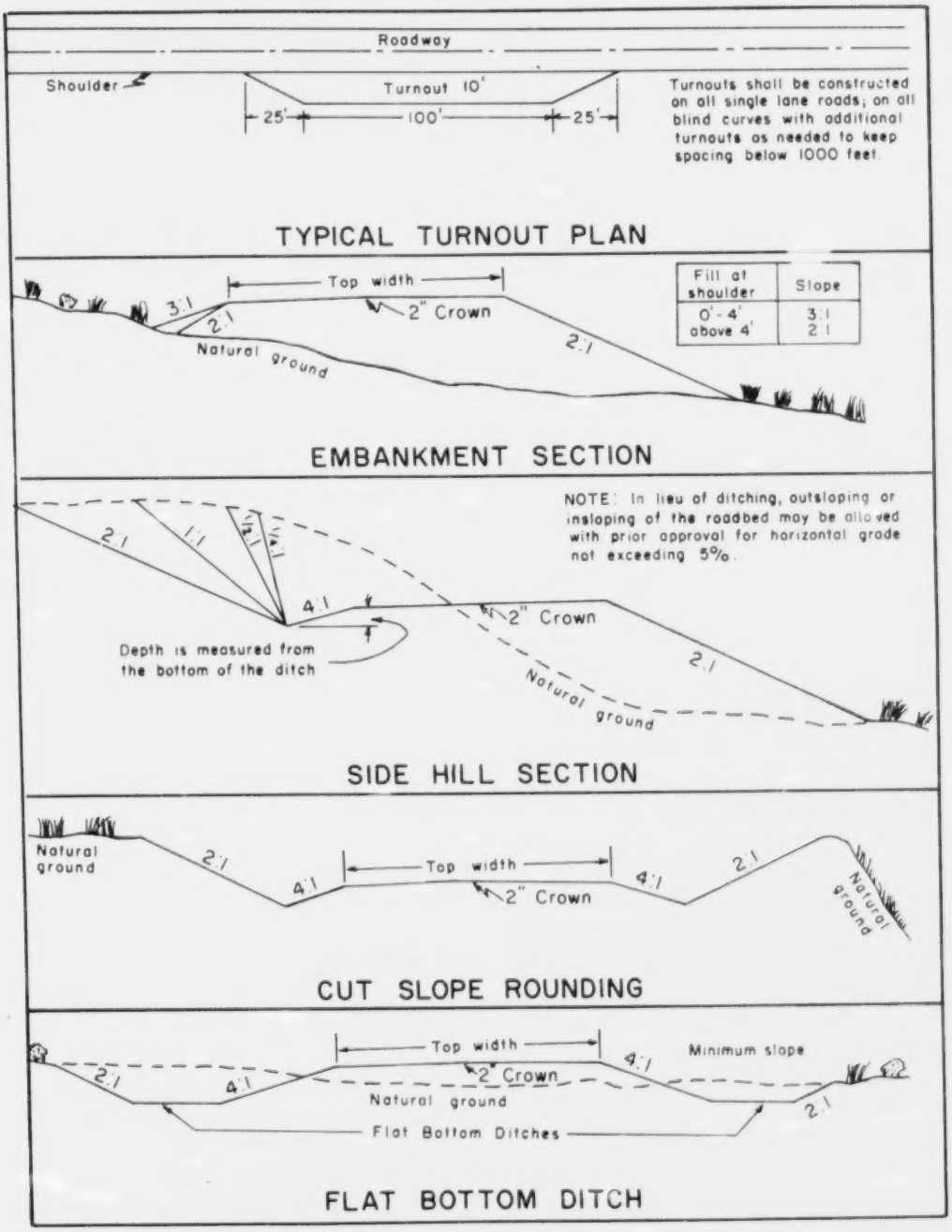
Normally, access roads are limited to one main route to serve the lease area with a maintained road to each well. Typically, roads are constructed to standards shown in Figure 1-21. Upgrading of temporary roads may include ditching, draining, installation of culverts, gravelling, crowning, or capping the roadbed. Surface area needed for roads would be similar to temporary roads and also dependent on how level or hilly an area may be.

When an oil field is developed on the spacing pattern of 40 acres per well, the wells are approximately 1,320 feet apart in both north-south and east-west directions. If a section (a square mile) is developed with 16 wells, at least four miles of access roads are built. Although the size of most fields ranges from less than 1,000 acres to several thousand, a few major fields cover several townships. If a major field is discovered and developed on a 40-acre well spacing pattern, a township may have 576 wells and over 200 miles of road.

The most important factor in further development may be the quantity of production. If the discovery well has a large capacity and substantial reserves are indicated, development drilling may occur at a much slower pace.

FIGURE 1–21

TYPICAL ROAD SECTIONS



Source: Bureau of Land Management, 1977.

An evaluation period to observe production performance may follow between the drilling of successive wells.

Development on an individual lease basis may proceed more rapidly than under unitization, since each lessee must drill his own well to obtain production from the field. On a unitized basis, however, all owners within the participating area share in a well's production regardless of whose lease the well is on.

Drilling in an undeveloped part of a lease, to prevent drainage of petroleum to an offset well on an adjoining lease, is frequently required in fields of intermingled federal and privately-owned land. The terms of federal leases require such drilling or compensatory royalty if the offset well is on nonfederal lands, or on federal lands leased at a lower royalty rate.

Many fields go through several development phases. A field may be considered fully developed and produce for several years, then wells may be drilled to a deeper pay zone. Discovery of a new pay zone in an existing field is a "pool" discovery, as distinguished from a new field discovery. A pool discovery may lead to the drilling of additional wells—often from the same drilling pad as existing wells—with the bore holes separated only by feet or inches. Existing wells may also be drilled deeper.

Production

Production in an oil field begins soon after the discovery well is completed and often concurrently with development operations. Temporary facilities may be used at first, but as development proceeds and reservoir limits are learned, permanent facilities are installed. The extent of such facilities is dictated by the number of producing wells, expected production, volume of gas and water produced with the oil, the number of leases, and whether the field is to be developed on a unitized basis.

Production in a gas field does not begin until the pipeline to a market has been constructed. Sales pipelines are not justified until sufficient gas reserves are proved by drilling operations. Gas wells are often shut in after completion for periods ranging from months to years until pipeline connections are available.

Some natural gas contains hydrogen sulfide,which is a highly toxic and flammable gas. Presence of hydrogen sulfide in a formation can cause problems while drilling, as well as during production. High carbon steel, used for drilling and casing deep holes due to its high strength, will shatter like glass when exposed to high concentrations of hydrogen sulfide. Natural gas containing significant amounts of hydrogen sulfide is known as "sour gas." The hydrogen sulfide must be removed before the gas enters a commercial pipeline. If sour gas is produced in quantities insufficient to justify this removal, it must be flared. If combustion during flaring is complete, only sulfur dioxide is emitted into the air. If incomplete combustion occurs, other sulfur compounds including hydrogen sulfide are emitted into the air. Oil wells producig from formations containing hydrogen sulfide represent a hazard to personnel if dissolved hydrogen sulfide is present in the oil. Hydrogen sulfide smells like rotten eggs in low concentration, but prolonged exposure tends to dull the sense of smell. Hydrogen sulfide is heavier than air and will concentrate in low-lying areas and depressions. Under certain conditions, it can form an explosive mixture with air in concentrations over four percent by volume. Drill crews are aware of this problem and take precautionary measures to avoid this occurrence. Gas sweetening plants may be built to produce elemental sulfur from hydrogen sulfide in the natural gas.

Most wells in the three state study area require an artificial lift to bring the oil to the surface. Pumping and a technique known as "gas lift" are the two artificial lifts used. Naturally flowing wells and wells with gas lift facilities use a minimum of equipment at the surface and produce little or no sound. All surface pump systems require more surface equipment and make more noise than flowing wells and gas lift facilities.

Surface pumps are usually powered either by electric motors or internal combustion engines. Operators prefer electric motors because they make less noise, require less maintenance, involve less fire hazard, are more dependable, and can be more easily automated than internal combustion engines. However, internal combustion engines must be used in many oil fields where electric power is not available. If there is sufficient casing head gas (natural gas produced with the pumped oil), or another gas source is available, it may be used to fuel internal combustion engines. Butane and propane are also used as fuels. Single-cylinder engines operate at high noise levels, whereas multicylinder engines operate at lower noise levels.

Most existing wells in the three-state area have weak water pressure and require pumping. Both surface and subsurface (submersible) pumps are used; however, subsurface pumps are much less common. The horsehead pump (Figure 1-22) is most commonly used in the study area.

Surface units used with sucker rod pumps are fitted with guard rails, belt drive shields, and fences for safety. These pumps, as well as the accompanying tanks and other facilities, can be painted in earth tone colors to blend with the landscape.

Gas lift is used in some oil field where high pressure natural gas is available, and where pressure in the petroleum reservoir is sufficient to force the petroleum part of the way up the well. The addition of gas lowers the specific gravity of the petroleum so that it flows to the surface. However, this method will be used less in the future as supplies of high pressure natural gas decline.

Figure 1-22: Horsehead Pump

Most gas wells produce by normal flow and do not require pumping. Surface use at a flowing well is usually limited to a 20-foot by 20-foot fenced area containing a gas well Christmas tree. If water enters a gas well and chokes off the gas flow, a pump may be installed to pump off the column of water. After the water is removed, the gas flows to the surface until water chokes it off again. Some gas wells may require almost continual water pumping.

Crude oil is usually transferred from wells to a central storage tank battery (Figure 1-23) before it is transported from the well site by truck or by pipeline.

Natural gas is often sold at the wellhead and transported directly off the lease. If processing is required to remove liquid hydrocarbons or water, however, the gas may be transferred to a central collection point prior to sale. On some leases, the production from several wells is piped to a central gathering station and then piped in a larger line to the storage batteries.

Pipelines used within the field are commonly from 4 to 6 inches in diameter between the well and gathering station. Pipelines between the gathering tanks and treating stations may be 4 to 8 inches in diameter. These pipelines may be buried without a protective coating in areas where soils are not corrosive. Briny water mixed with the oil can also corrode pipelines, causing them to wear out and develop leaks more rapidly. Such leaks are easier to detect and repair if the pipelines are placed on the surface rather than underground.

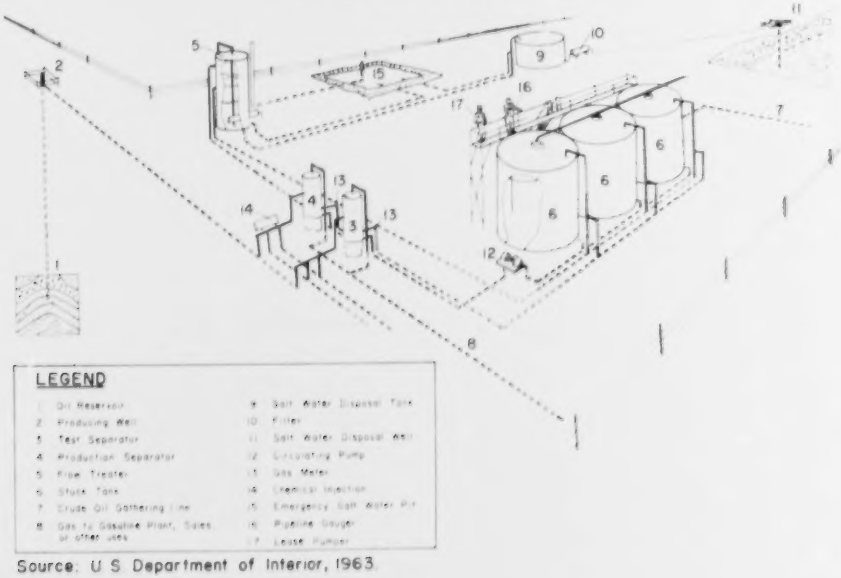
If the oil contains gas and water, they are separated before the oil is stored in the tank battery. The treating facilities are usually located at a storage tank battery (Figure 1-24).

Low pressure petroleum that must be pumped from the well is normally treated in a single separation; high-pressure flowing petroleum may require several stages of separation with a pressure reduction accompanying each stage.

If enough casinghead gas is separated in the field to make it economical to process it for marketing, a plant may be built to remove gasoline, butane, and propane. Some of the remaining gas is used to fuel the plant and

FIGURE 1–23

FLOWING OIL PRODUCTION



Source: U.S. Department of Interior, 1963.

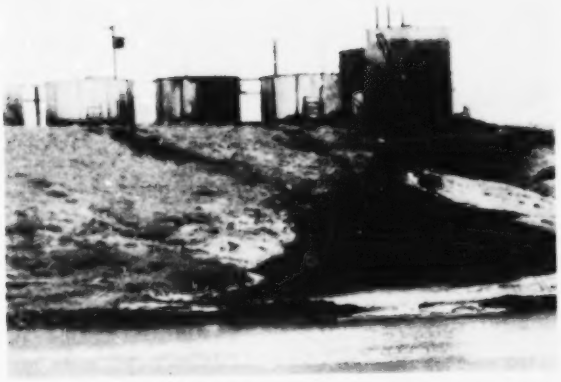


Figure 1-24: Storage Tanks and Oil Treatment Facilities

the remainder is sold. If the volume of casinghead gas produced in a field is insufficient to warrant treatment in a gas plant, it is usually used as fuel for pump engines in the field and as heating fuel for oil treaters. If the gas exceeds fuel requirements on the lease, it may be flared or vented to the atmosphere.

If water is produced with the petroleum, it is separated before the gas is removed. In primary operations, where natural pressures or gravity cause the petroleum in the reservoir to flow to the wells, the degree of mixing usually is high enough to require chemical and heat treatment to separate the oil and water. Heat applied to the bottom of the treaters breaks the emulsion. The heat is supplemented in most cases by chemical emulsion breakers.

In secondary production, where water injection or other methods are used to force additional petroleum to the well bore, the oil and water often are not highly emulsified. In this case, the oil and water may be separated by gravity in a tall settling tank. Water injection may require additional wells and maintenance roads.

After the oil and water are separated, the oil is piped to storage tanks located on or near the lease. There are normally at least two tanks so that at least one tank can be filled as the contents of the other are measured, sold, and transported. The number and size of tanks vary with the rate of production on the lease, and with the extent of automation in gauging the volume and sampling the quality of the tank's contents.

Although most produced waters are brackish to highly saline, some are fresh enough for beneficial use. In the past, ranchers have filed claims on oil field water so they can use it for agricultural or livestock purposes. Montana, North Dakota, and South Dakota law require that disposal permits be obtained from the Department of Health and Environmental Sciences, Department of Health, and Department of Environmental Protection, respectively. The discharged water must meet certain water quality standards.

Because water may not come from heater-treaters completely free of oil, oil skimmer pits may be established between separating facilities and surface discharge.

When salt water is disposed of underground, it is usually introduced into a formation containing water of equal or poorer quality. It may be injected into the producing zone from which it came or into other producing zones. In some cases, this stimulates oil production. In other cases, it could reduce the field's productivity and may be prohibited by state regulation or mutual agreement of the operators.

In some fields, dry holes or depleted producing wells are used for salt water disposal; occasionally, new wells are drilled for disposal purposes. Cement is squeezed between the casing and sides of the well to prevent the salt water from migrating up or down from the injection zone into other formations.

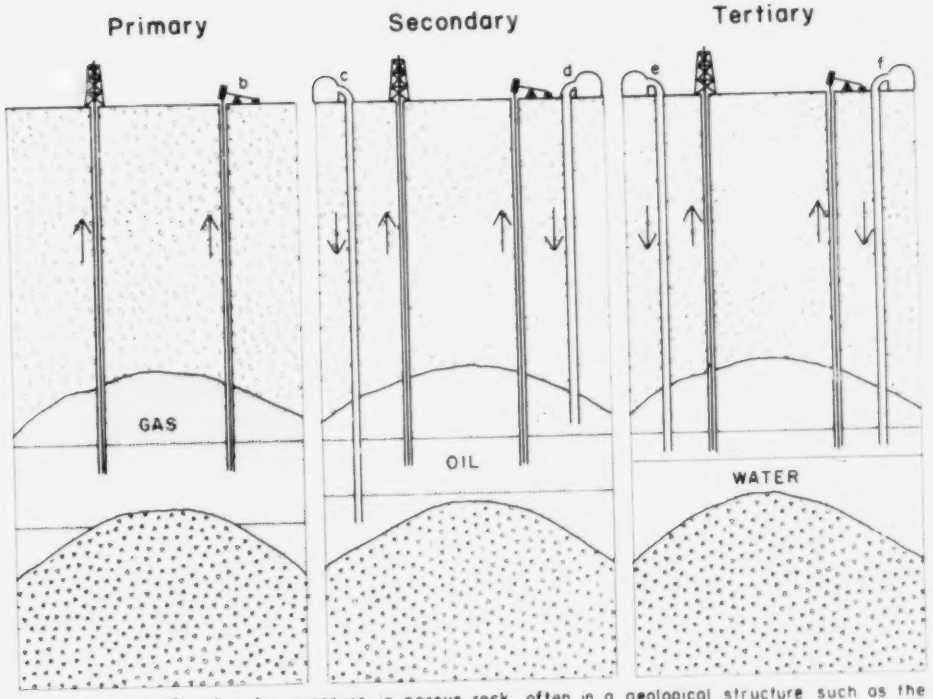
Underground oil is usually under pressure. Drilling into the oil reservoir releases the pressure and allows oil to flow into the well where it rises to the surface. Oil recovery under natural pressure conditions is considered "primary" production. Primary production accounts for about 25% of the oil in a reservoir. In fields where it is economically feasible, "secondary" recovery methods are used. This involves pumping water or gas into the reservoir to increase oil production by increasing the pressure in the reservoir. "Tertiary" recovery methods can sometimes increase recovery rates if the viscosity of the oil is lowered so that it flows more easily either by heating the oil or by injecting chemicals into the reservoir. Heating of reservoir oil can be accomplished by injecting steam into the reservoir. Tertiary recovery methods are not yet widely used in this country. By the year 2000, reservoir production from any given oil reservoir is expected to average 40% nationally. Figure 1-25 shows primary, secondary, and tertiary methods of oil recovery. Secondary recovery is currently used in 103 (about 50%) of the oil fields in the three-state study area.

Waterflooding is the method used in about 90% of the three-state area's secondary recovery efforts. Water is injected into the reservoir to increase reservoir pressure and drive additional oil to the surface.

The water supply is usually a brine obtained by drilling in the waterflood area. Fresh water is not desirable for waterflood purposes because it may form chemical bonds with clays in some reservoir rocks and reduce the permeability of the reservoir formation. When fresh water is used, the amount is not large (50 to 10,000 gallons a day) when compared to other uses of fresh water such as agricultural irrigation. About 93 fields in the three-state area are injecting water for secondary recovery purposes.

FIGURE 1–25

METHODS OF OIL RECOVERY



Oil is generally found under pressure in porous rock, often in a geological structure such as the one shown here. Drilling a well into the oil-bearing stratum releases the pressure, and in primary production the oil flows to the surface (a) or is pumped out (b). When the natural pressure is too low to bring the oil to the well, secondary recovery may be achieved by pumping water (c) or gas (d) into the field to increase the pressure. In tertiary recovery the oil's viscosity is lowered by injecting steam, which heats it (e), or by injecting a chemical (f).

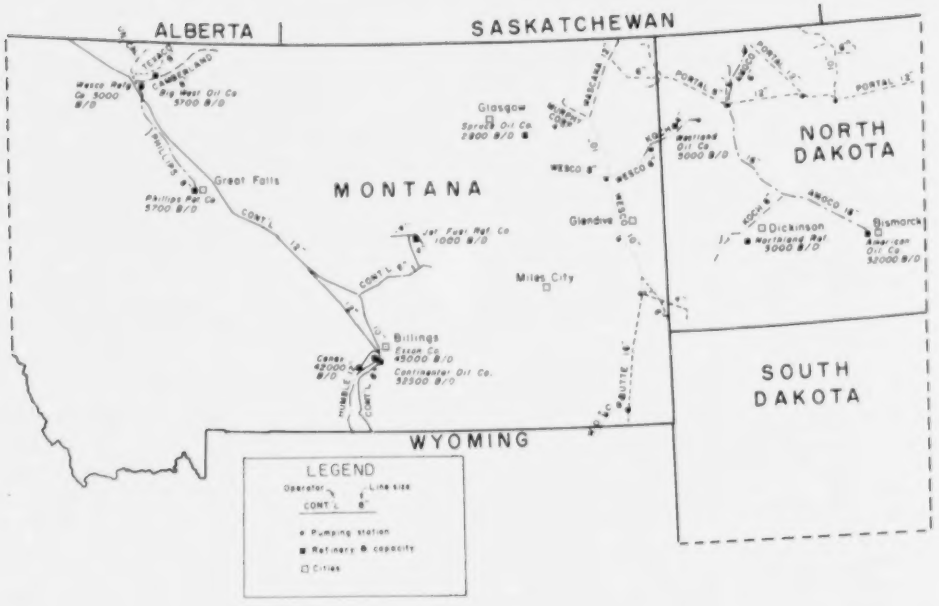
Source: Scientific American, vol. 238, no. 38, March 1978.

In some cases, formation fracturing is utilized. This is a method of stimulating production by increasing the permeability of the producing formation. Under extremely high hydraulic pressure, a fluid (such as water, oil, alcohol, dilute hydrochloric acid, liquefied petroleum gas, or foam) is pumped downward through tubing or drill pipe and forced into the perforations in the casing. The fluid enters the formation and parts or fractures it. Sand grains, aluminum pellets, glass beads, or similar materials are carried in suspension by the fluid into the fractures. These are called propping agents or proppants. When the pressure is released at the surface, the fracturing fluid returns to the well, and the fractures partially close on the proppants, leaving channels for oil to flow through them to the well. This process is often called a frac job. In most cases, this procedure requires significantly more land disturbance associated with preparing the drilling area because of the additional tanks and pumps required for the fracturing process.

Pipelines are needed to transport the oil from gathering stations to refineries. Figure 1-26 shows the existing oil pipeline network in Montana and North Dakota. As existing fields increase production or new fields begin production, new pipelines will be needed. These new lines would vary in size from 4 to 16 inches in diameter ranging in length from a few miles to tie into an existing pipeline, or hundreds of miles to supply an oil refinery. Crude oil lines are usually buried. Construction of a pipeline requires excavating and hauling equipment, temporary and permanent roads, pumping stations, clearing the right-of-way of vegetation, and possibly blasting. Figure 1-27 shows a typical pipeline construction spread while Figure 1-28 shows the laying out of pipe along the proposed route.

FIGURE 1–26

MAJOR CRUDE OIL PIPELINE SYSTEM—1976



Source Western Oil Reporter, July, 1976.

FIGURE 1–27

TYPICAL PIPELINE CONSTRUCTION PROCEDURES

Figure 1-28: Oil Pipeline Route Awaiting Assembly and Burial

Pipelines for natural gas also would be needed to transport the gas from gas fields to the market place. Figure 1-29 shows the existing natural gas pipeline system in the three-state area. As with oil pipelines, the diameter and length would vary. Compressor stations may be necessary to increase production pressure to the same level as pipeline pressure and to maintain pipeline pressure. Construction techniques for natural gas lines are similar to those used for oil pipelines.

Abandonment

Well plugging requirements vary with the rock formations, subsurface water, and the well. Generally, however, the hole is filled with heavy drilling mud to the bottom of the cemented casing. A cement plug is installed at the bottom of the casing, the casing is filled with heavy mud, and a cement cap is installed on top. A pipe is required as a monument, giving location and name of well unless the requirement is waived by GS. If waived, the casing may be cut off and capped below ground level. Protection of aquifers and known oil and gas producing formations may require placement of additional cement plugs.

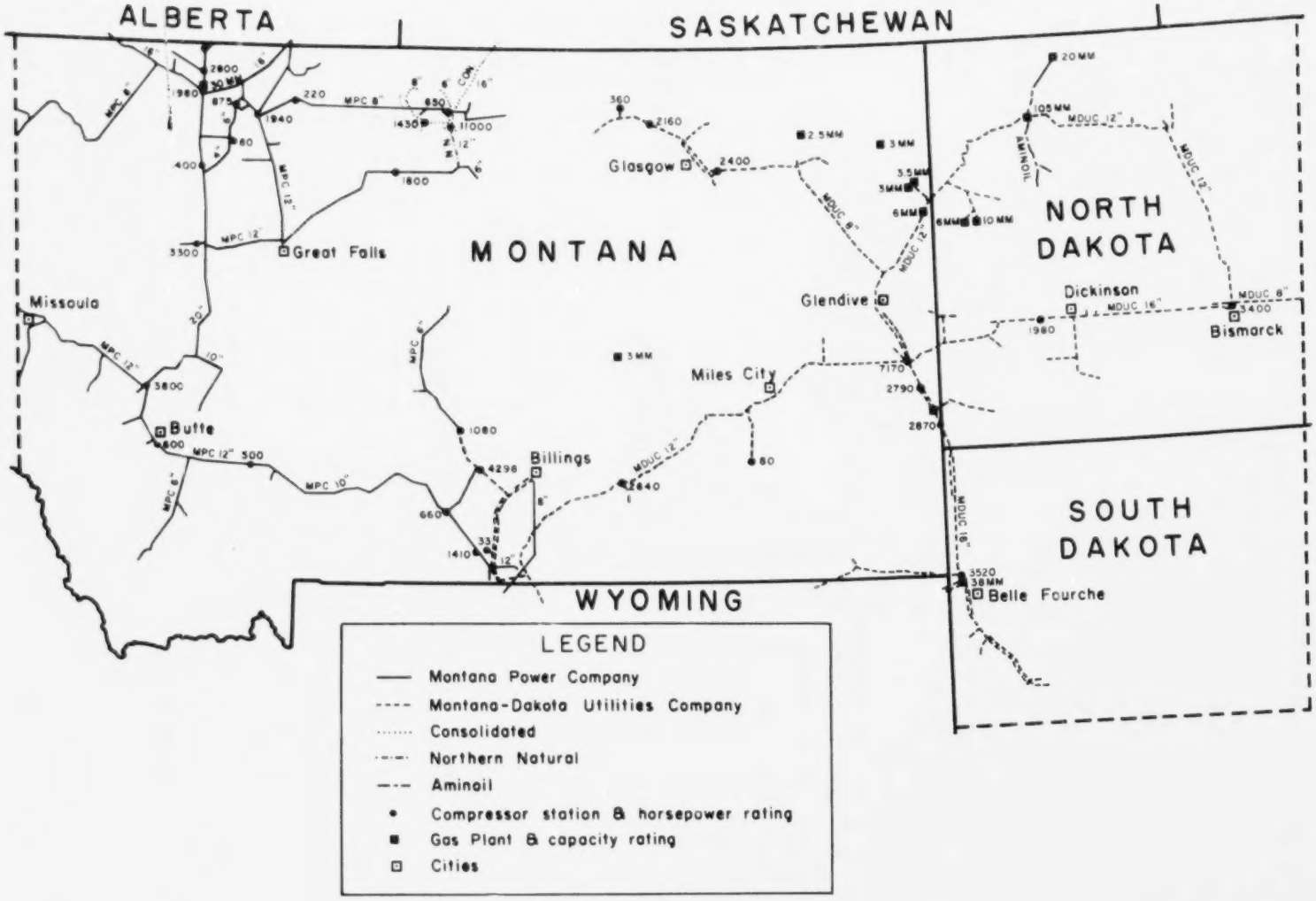
After plugging, the drilling rig is removed and the surface, including the reserve mudpit, is restored to the requirements of the surface management agency. In some cases, wells are plugged as soon as they are depleted. In others, depleted wells are not plugged immediately but are allowed to stand idle for possible later use in a secondary recovery program.

Truck-mounted equipment is used to plug former producing wells. In addition to the measures required for a dry hole, plugging of a depleted producing well requires a cement plug in the perforated section in the producing zone. If the casing is salvaged, a cement plug is put across the casing stub. The cement pumpjack foundations are removed or buried below ground level. When an entire lease is abandoned, the separators, treaters, and other processing and handling equipment are removed and the surface restored using topsoil which was stored when the site was leveled. Surface flow and injection lines are removed but buried lines are usually left in place and plugged at intervals as a safety measure.

Appendix 1 presents additional information and assumptions pertaining to the physical characteristics of an "average" drilling operation in Montana and the Dakotas.

FIGURE 1–29

MAJOR NATURAL GAS PIPELINE SYSTEM—1976



Source: Western Oil Reporter, February, 1977.

CHAPTER 2 ENVIRONMENTAL CONSEQUENCES

BUTTE DISTRICT ACTIVITY

Oil and gas exploration activity in the Butte District is significant. Most of the district is within the Overthrust Belt, which typically consists of limestones, sandstones, and shales of Precambrian through Mesozoic age. These have been completely folded and repeated by many west-dipping thrust faults. Montana's first oil production occurred in the Overthrust Belt in the Kintla Lake area of Glacier National Park, but enthusiasm died when commercial production was not established. Oil was discovered in Swift Current Valley on the east side of Glacier Park in 1903, but by 1906 water encroachment shut down production.

Exploration in the Overthrust Belt was slow and sporadic for the next 48 years until Union Oil Company drilled the Morning Sun well outside of East Glacier in 1954. Large flows of gas and condensate were measured; however, attempts to establish commercial production failed.

Exploration continued at a faster pace after Union's near success, and in 1957 the Blackleaf No. 1 was completed. It produced 6.3 million cubic feet of gas per day. Additional wells were drilled in the area, several of which had significant shows of gas. However, the high cost of drilling, poor market conditions, and large discoveries in other areas of Montana once again put a damper on activity in western Montana.

Large discoveries of oil and gas were made in the mid-1970s in western Wyoming and northern Utah. This caused renewed interest in the entire Overthrust Belt. Since that time there has been a marked increase in leasing, exploration, and drilling in the Montana portion of the Overthrust Belt.

Major production in the Butte District was first established in the early 1920s in the Conrad-Pondera area. The area produced 305,700 barrels of oil in 1979, or an average of 837 barrels per day. During the same period the area produced 1.37 billion cubic feet of gas. Approximately 725 holes have been drilled in the district on state, federal and private lands, including 586 holes on the Sweetgrass Arch and 144 in the Overthrust Belt.

It should be noted that this assessment assumes that each oil and gas lease issued by the BLM carries with it the possibility of development and production. The potential impacts described in this chapter are based on past experience in Montana with oil and gas activities and similar surface-disturbing activities. Assumptions and guidelines considered in the analysis of potential impacts resulting from oil and gas development are outlined in Appendix 1.

IMPACT SUMMARY

The following summary presents the impacts of the proposed action that are considered most significant. The "Environmental Impact Assessment" section of this chapter contains a more detailed description of environmental impacts within the study area.

THE PHYSICAL ENVIRONMENT

Geology

No significant geologic impacts would be expected.

Soils

Soils in affected areas would be disturbed during all stages of development. Impacts would result from the simultaneous effects of bared soil, rainfall, slope, vegetation destruction, compaction from construction equipment, and many other factors. Soil productivity would be reduced by wind and water erosion of topsoil, soil compaction by heavy equipment, loss of protective vegetation, and mixing of soil horizons. Contamination of soils from fuel, crude oil, drilling fluids, and inferior fill materials would be highly possible. Soils under storage tanks, roads, parking lots, holding basins, pads, and other land-consuming projects would be lost to production.

Topography

No significant impacts on topography would be expected.

Water

Possible impacts to the hydrologic features would be an increase in sediment yield and a reduction in the amount and quality of water from wells and springs. Downstream contamination would be possible in certain areas, particularly on or near floodplains, if an oil spill should occur. The main areas of concern are saltwater contamination of groundwater through poor casing and well-abandonment procedures, releases of oil, and improper disposal of saline water produced with oil.

THE BIOLOGICAL ENVIRONMENT

Vegetation, Range, and Forestry

Impacts would result from the direct destruction of plant cover by all phases of oil and gas activity. The area-specific magnitude of impacts depends upon slope, climatic conditions, soils, and vegetative types involved.

Fish and Wildlife

Major impacts are caused by road, pad, and pipeline construction, which could result in habitat and forage loss, degradation of fish habitat as a result of pollution and road construction adjacent to streams, and harassment of wildlife as a result of higher levels of human activity. The magnitude of these impacts will vary, depending on the affected species, the rehabilitation potential of the affected habitat, and the duration of the activity that causes the impacts.

LAND USES

Recreation

The presence of people and equipment during all phases of oil and gas activity could disrupt big game populations and distribution, causing a negative impact on the quality of hunting and wildlife observation. Extreme disturbance around areas used for recreation would detract from the recreation experience of visitors. Roads would add to enforcement problems in areas designated for ORV use, and the presence of operators could impair benefits derived from the designation. The enjoyment of scenic quality during travel could be degraded, particularly by the presence of oil and gas activity adjacent to travel zones.

Wilderness

The most significant effects on the wilderness resource would be the temporary loss of solitude and the changes in the apparent naturalness of the land and its resources.

Visual Resources

The most significant adverse impacts on visual resources would occur for development and production phases on Class A scenic quality lands and on Class B scenic quality lands with low visual absorbtion capability and/or high visual sensitivity. However, some significant adverse impacts could occur for all phases on any scenic quality class area.

Cultural Resources

Major impacts to cultural features could include loss of spatial association of artifacts, the destruction of the artifacts themselves, and increased artifact collecting, particularly in areas known to contain many sites.

THE SOCIOECONOMIC ENVIRONMENT

Economic and Social Conditions

Adverse impacts on local economic and social conditions would occur primarily in connection with population growth in areas that do not have capacity for additional housing or services. The largest impacts would occur during labor intensive development in areas of large scale developments. An example would be population influx due to tank and flow line construction at a major discovery.

To the degree that leasing results in production of oil and gas, it could have a favorable economic impact on a state, regional, and national basis. This is especially true to the extent that any production would offset foreign energy imports. Development of oil and gas would provide increased employment in construction, supply, and service industries in the area. Production also would increase the county tax base, improving the ability of counties to finance government services.

THE ROCKY MOUNTAIN FRONT

Development could have significant impacts on the wilderness, wildlife, and recreational values of the Rocky Mountain Front. It is important that agencies coordinate their activities to avoid unacceptable impacts from the cumulative effect of separate oil and gas activities.

ENVIRONMENTAL IMPACT ASSESSMENT

The description in this section of impacts that could occur is based on our knowledge of *current* oil and gas operating procedures and technological constraints; no effort has been made to project the effects of future technology. Within each environmental component, the discussion of impacts is arranged according to the phase(s) of oil and gas activity from which impacts are likely to occur. In some cases, discussions by activity have been combined within a component to avoid duplication.

The five phases of onshore oil and gas activities that can result in environmental impacts are preliminary exploration, exploratory drilling, development, production, and abandonment. A detailed decription of these phases appears in Chapter 1, "Proposed Action," under the heading "Phases of Onshore Oil and Gas Activity."

The impact assessment that follows is complemented by the Dillon Resource Area Management Framework Plan (MFP) completed in 1979. The Dillon MFP includes more detailed, site-specific information and management guidance for a wide variety of resource values and uses. It provides for the leasing of public oil and gas ownership on areas where impacts to surface resources and values can be kept within acceptable levels, and it identifies areas that will be leased with no surface occupancy and/or with other special stipulations.

The Dillon MFP also identifies areas where geophysical exploration activities requiring the use of motorized vehicles will be restricted or excluded to protect resource values. An example of the type of resource-specific and area-specific information available for the Dillon Resource Area is displayed on the sample map from the *Mountain Foothills Environmental Impact Statement*, which is in the pocket inside the back cover. The complete set of Mountain Foothills EIS maps is available for review in the Dillon Resource Area office.

The Dillon MFP will be consulted during the processing of individual lease applications. Land use plans for the Headwaters and Garnet resource areas are being revised; completion of those plans is scheduled for 1983 and 1985, respectively. Until that time, field reviews will be conducted when necessary to assess impacts and develop stipulations for each lease application.

THE PHYSICAL ENVIRONMENT

Geology

Although surface exploration activity and subsequent deep exploratory drilling could cause negative impacts on paleontological features, these probably would be offset by the knowledge that could be gained through geologic interpretation of information gathered concerning the structure, stratigraphy, and hydrologic history of the area. In addition, mineral resources other than oil and gas could be discovered through oil and gas activity, and the nation would benefit from the use of the petroleum resources. Furthermore, many fossils never would have been discovered if surface-disturbing activities of the sort associated with oil and gas work had not been carried out; therefore, beneficial impacts may occur from exposure of subsurface material. New information could be obtained, such as knowledge of the history of depositional environments, structure, stratigraphy, and fossil evolution.

Impacts could occur if oil/gas activity should conflict with the development of other mineral resources.

Soils

Preliminary Exploration

By far the greatest impact on soils in this phase of oil and gas activity is compaction by vehicles, road-building, and other related activities. The use of unimproved roads and trails also can cause water erosion and compaction.

Compaction occurs when a compressing weight at the surface causes spaces in the soil matrix to collapse. The soil then becomes more dense. This most often occurs when the soil is moist after a rain or spring snowmelt. Usually the most severe compaction occurs when the soil surface appears dry. Once soil is compacted, a return to normal may require many years. Compaction of soil by vehicles and heavy equipment passing repeatedly over the soil severely limits root penetration, air and moisture infiltration, and vegetation production. The result often is barren soil. Vehicle ways and access roads that have not been traveled for years often show little revegetation in the wheel tracks because there is a compacted layer in the subsoil and because nutrient-rich topsoil has been lost.

Exploratory Drilling

Exploratory drilling for oil and gas may involve the construction and use of additional roads or trails. Use of these causes compaction. The amount of compaction and the resulting impact will vary depending on the soil type and associated moisture content at the time of compaction. Again, the impact will be most severe when the soils have high moisture content and are in the process of drying out. This situation occurs most frequently during spring and early summer and is least likely to occur during fall and winter.

Sensitive and critically sensitive classes of soils are most susceptible to compaction during early spring and late winter thaws. On most soils, compaction results in a decrease in infiltration rate and an increase in runoff; this accelerates erosion, creating rills and gullies.

Exploratory drilling may result in dust, rock chips, cuttings, and toxic chemicals being brought to the surface and deposited near the drill hole. There will be fewer toxic chemicals in exploratory drilling than in the development and production phases. Some roads would be built during exploration for access to prospective oil and gas sites. Impacts of road-building will depend upon soil type, topography, time of year, and the duration of the activities. Impacts of turnouts, stream crossings, cuts and fills, road design, and road widths will depend upon topography and hydrologic features in the exploration area.

Soil disturbance may affect adjacent areas. Wind and water erosion is a serious problem on many soils in the district; this erosion problem is increased when the areas are further disturbed by the construction of seismic and access roads and drill pads. Such areas are more susceptible to erosion because of the increased volume of detached soil particles, which are easily moved by wind and water. Soils with thin topsoil horizons provide a shallow mantle of protection. The soils formed on the Boulder Batholith and soils in the Devils Fence area are some that fall into this category.

The erosion potential of any soil increases with slope or with a decrease of vegetation. Soils that now show symptoms of accelerated erosion, such as rills and large areas of sheet erosion, will be most seriously impacted by any soil-disturbing activities. Such soils usually are related to areas having lower annual precipitation. Rehabilitation of these soils is more difficult because of past losses of topsoil and nutrients and because of inherent low fertility.

Development and Production

Impacts on soils in these phases will be comparable to those described under "Preliminary Exploration," but on a larger scale.

Fluids brought to the surface may contain fresh, brackish, or saline waters containing chlorides, carbonates, and sulfates. These usually toxic solutions may act as soil sterilants, breaking down soil bacteria processes and interactions. Toxic materials may persist several years until they are finally broken down or leached from the upper profile.

Oil spills, although not commonplace, do occur from time to time. Oil may seep into pits, berms, and, in extreme cases, into drainages and low areas around wells. Permeable soils will be most affected by oil seepage, because coarse and moderately coarse textured soils allow the deepest penetration into substrata. Oil usually enters soils at a slower rate than water. Oil thickness, composition, and chemical makeup are variable factors from well to well, and those characteristics affect the rate of infiltration into different soil textures. Oil spills in active streams may be carried downstream, affecting streambank soils along the way.

Clearing and leveling of drill pads would increase erosion over an area of 0.5 to 5 acres. Reserve and waste pits may be built nearby to contain drilling muds and formation fluids, and such construction activities could affect slope stability in steeper areas. Additional slope failure and slumping could be induced by saturation from fluids or overloading by heavy equipment. Slope contributes significantly to erosion hazard and revegetation problems (see Table 2-1). In large oil fields with many wells, any adverse impacts will be repeated each time drilling and development occurs.

TABLE 2-1

SLOPE LIMITATIONS ON OIL AND GAS CONSTRUCTION PROJECTS

Common Slopes	Erosion Hazard	Revegetation
0 - 10%	Slight	High success
10 - 20% [a]	Moderate	Moderate success
20 - 30%	Moderate—critical	Fair success
More than 30%	Critical—severe	Poor success

a. Most slopes greater than 15% without established vegetative cover will erode at a greater rate than that at which the soil-forming process can form soil.

Abandonment

Salvaging buildings, drill pad equipment, other oil field equipment and improvements would cause reoccurrence of impacts as described for the construction phase. Replacement soil material may be less productive than the original soil. New borrow areas may be required to meet these site rehabilitation needs.

Topography

Preliminary Exploration

Impacts on topography during preliminary exploration will be limited to access roads that generally cross contours. The steeper the slope, the greater the impact of the road on the topography.

Exploratory Drilling

Impacts on topography from exploratory drilling activities would generally be limited to areas of less than 5 acres. The most significant change would occur during pre-drill site preparation, and impacts would increase as slope increases. If flat pads of 1 to 5 acres are constructed on steep slopes (20 to 30%), the total area disturbed becomes larger as slope increases.

Additional topographic impacts occur if slopes are unstable. Failure of slopes after cutting (or fill slope failure) can cause offsite disturbance. The offsite disturbance may be a slump escarpment, a slump itself, or some other phenomenon related to mass movement. Minor infraction of slope equilibrium onsite could ultimately lead to major mass movement difficulties offsite.

No beneficial impacts to topography would be expected unless some feature, such as a severely eroded slope with gullies present, was recontoured and once again made to conform with the natural landscape.

Development

Because additional wells are needed to delineate the field boundary, impacts from development would be similar to those from exploratory drilling. Minor contour change could occur during alignment and installation of pipelines and upgrading of roads. Collection facilities and buildings would require some surface disturbances. Once again, the extent of changes caused to natural topographic features is related to slope.

Production

Storage tanks, separators, pipelines, and treatment facilities could cause topographic disturbance in mountainous, steep, hilly, or other irregular landforms. Major contour changes often are highly contrasting to the natural topography. Construction of reservoirs for dewatering or secondary recovery can impinge on natural topography by creating artificial ponds, embankments, or levees, all radically different from the existing contours. These differences will remain at least until abandonment.

Abandonment

Impacts from abandonment would be minimal. Examples would be slope failure after site rehabilitation efforts were completed and gully erosion occurring because improper soil stabilization techniques were used.

Most topographic changes will be permanent unless the landscape is gently rolling or shallow flat slopes. Recontouring seldom matches the natural topography. Restoration of disturbed areas on steeper slopes usually results in a more gentle topography because machinery used in rehabilitation work cannot operate on steep slopes. In addition, the usual techniques employed in rehabilitation would lead to erosion if slopes exceeded 20% and lengths exceeded 100 to 200 feet.

Water

The oil and gas industry has operated in the study area for many years, in some cases affecting the water resource and altering the quantity and quality of both surface water and groundwater. Various laws have been passed, and regulations have been developed at the federal and state level to reduce the impacts to the water resource. These regulations govern such things as the amount of earthmoving work, the discharge of produced oil field water, and the plugging of abandoned wells. Impacts often result from noncompliance with regulations and permit stipulations.

The impacts discussed in this section are not identified by exact legal or geographic locations. Rather, they are identified in geomorphic terms such as stream channel areas, steep areas, and floodplain areas. This was done because it is impossible to forecast specific locations of future oil and gas development which may result in hydrologic impacts.

Preliminary Exploration

Erosion and Sediment Yield. Cooperation between the BLM and seismograph companies concerning the placement of access trails and the amount of bulldozer work has reduced the amount of erosion and sediment yield from seismograph trails; however, new trails may cause erosion and sediment yield. The amount of damage that occurs is site-specific, depending upon the type of soil, vegetative cover, and slope.

The most severe problems to the water resource occur where the trails cross stream channels. If earthmoving work is needed, the disturbed area may yield large volumes of sediment to the stream channel. In the ephemeral and intermittent stream channels where this work generally occurs, it is only a short time before the sediment is transported to perennial waters.

Sediment transport by streams increases turbidity, alters the stream channel characteristics, and adversely affects the municipal, agricultural, and industrial uses of water. No information is available to quantify the extent of this impact.

Groundwater. The detonation of explosives for seismographic exploration can seriously affect shallow groundwater wells and springs. The shock from such

explosions may alter the aquifer and significantly reduce water yields to both wells and springs, and water quality in wells and springs can be altered.

Exploratory Drilling

Erosion and Sediment Yield. Access roads and drill platforms are subject to erosion. Floodplains and wetlands are critical areas in terms of the amount of sediment yielded to streams. Oil and gas development in these areas could have an immediate effect on the turbidity, suspended sediment concentration, and bed load of a stream, and water uses ultimately would be affected. Wetland areas are connected directly with subsurface groundwater, which would also be contaminated. The Hydrologic Sensitivity map identifies floodplains and wetlands of concern. They are divided into sensitive and critically sensitive areas.

Disruption of groundwater movement could occur if wetlands and other areas with high water tables were developed. Poor compaction of berms or overfilling can cause failure of mud ponds. If this happens, drilling fluids can be released, causing erosion and contamination of streams.

Culverts usually are placed at all drainage crossings. Occasionallly, the culverts are not large enough to handle peak runoff and the crossing washes out, depositing sediment into the stream channel. Sediment deposited in ephemeral or intermittent stream channels then becomes available for transport to perennial waters. The sensitivity of major drainages in the study area is identified in the Hydrologic Sensitivity map.

Groundwater. When mud pits are used at the drilling site it is possible that groundwater sources near the surface could be contaminated by the drilling mud (sodium bentonite) and other products. Most of the wells drilled are far above the water table and present no problems; however, if wells were drilled on alluvial floodplains that are aquifers, the mud pit fluids and leachate products could percolate down into the groundwater, creating local contamination. A single well in an area would present a minor problem, but several wells could cause a significant problem, impairing the uses of groundwater or adjacent surface waters.

In addition to possible contamination from mud pits, the well itself can lead to interformation mixing of waters and degradation of groundwater quality. Present regulations, including cementing of the well casing, substantially reduce the chances of this occurring.

Development

The installation of pipelines, tank batteries, and permanent access roads increases erosion and sediment production. Site-specific impacts are discussed in more detail in the "Soils" section.

Production

Groundwater. The water that is separated from oil during the production phase is sometimes reinjected into the ground. There is a chance, through accident, of temporarily reinjecting contaminated water into a fresh water zone.

Surface Water. The most severe impact associated with the production phase is the oil spill. Oil spills generally occur when the petroleum is in transit, but may also occur during exploratory drilling and development. An oil spill entering a body of live water could have a significant and long-lasting effect. The oil might render the water unsuitable for domestic, wildlife, livestock, agricultural, and industrial uses. The impact from a spill, if the spill was unchecked, could extend miles downstream.

It is not feasible to analyze the probability or the impacts of spills occurring on each lease; however, oil field development along perennial streams has the greatest chance of causing a significant impact to the surface water resource. If an oil field is situated within a floodplain, any flooding could contaminate surface waters.

Some water from producing wells is held in evaporation ponds. These ponds are usually built to exclude natural runoff; if not, the possibility exists for reservoir failure or washout due to overflow.

Abandonment

The removal of tank batteries, pipelines, and other equipment during abandomment causes some additional surface disturbance. Erosion and sediment yield will decline after revegetation, but they will not be eliminated until the site stabilizes and the vegetation becomes well established. In the Butte District, this process could take several years, depending upon the site.

THE BIOLOGICAL ENVIRONMENT

Vegetation, Range, and Forestry Areas

The major impact on vegetation would be the direct destruction of plant cover by the construction and use of seismograph roads, trails, and drainage facilities. The degree of impacts from oil and gas activities varies with the development and with topography, climate, soils, and plant species.

Preliminary Exploration

The primary impact of preliminary exploration is from construction and use of roads and trails for access. The severity of the impact depends on the type of exploration and the terrain.

For geophysical exploration using a vibrator or similar methods in flat treeless areas, the impacts would be

miminal—usually breaking or uprooting of shrubs, brush, and small trees. For methods involving shallow drilling or shot-holes in rugged or mountainous terrain, the impacts would be greater. Access roads might need to be constructed, and this would require the use of bulldozers and heavy equipment. Removal of trees along access roads and excavation of small drill pads might be required. Improper disposal of drilling mud and accidental fire also could destroy vegetation.

Exploratory Drilling

The impacts associated with preliminary exploration also would occur in drilling, but to a greater degree. Higher standards of roads and larger drill sites are required for drilling; thus, impacts to vegetation could increase. The use of roads in wet weather could make them impassable in places, and vehicles driving around drill sites could cause additional damage. Impacts to forest vegetation would include road construction, accumulation of slash from cleared sites, and removal of commercial timber. Vegetation could be damaged by drilling mud or by toxic drilling fluids in the event of a mud pond washout. A drill pad might lose part of its potential for vegetative production because of soil compaction and contamination at the drill site.

Development

Development of oil and gas lease areas into active fields has a high impact on vegetation. At least one main route is needed to serve each lease area, with one access road to each well. This usually involves widening and upgrading temporary roads for all-weather use.

Drill pads are not completely rehabilitated in the short run if the well is successful. Often the perimeter of the drilling site, not required for the continued operation of the well, can be restored as nearly as practical to its original condition. Clearing for construction of buried pipelines causes some destruction of vegetation. To accommodate facility construction, a line is cleared along a secured right-of-way for installation and maintenance. Reseeding along rights-of-way after construction is not always successful; the amount of precipitation is an important variable. The resulting disturbed areas may be of low productivity, or weeds may invade an area.

The development and production phases of oil and gas activity create the greatest potential for conflict with ongoing and planned range and timber management programs. Oil and gas activities and facilities could interfere with or eliminate opportunities for range improvements, grazing systems, and access to grazing allotments. Similarly, opportunities to manage and harvest timber could be impaired.

Other impacts to vegetation in the area could be caused by toxic fumes, spillage of toxic materials, burial of waste pits, oil spills, leakage from flow lines, or accidental fire.

Production

Oil and gas well production has a relatively moderate impact on vegetation because the disturbance to vegetation would have already occurred during the development phase. Recurring oil field maintenance can affect areas that have undergone rehabilitation efforts, causing renewed damage. Vegetative damage would be minimal in most cases. Production water can contain higher concentrations of salts than natural waters. Over a long period, this could cause salt concentration in the soil that could reduce desirable vegetative production. Vehicle travel in a producing field could cause a continuing problem with noxious weeds.

Abandonment

Abandonment and rehabilitation of oil and gas fields would have a moderate impact on vegetation. Facilities can be removed, and most of the area can be reclaimed. These areas usually are revegetated artificially with the use of stockpiled topsoil provided for in the reclamation plan. Roadways, pads, or platforms sometimes remain, depending upon the type of fill material. Recreational benefits may preclude total rehabilitation of access roads into such an area.

Dust from roads, construction areas, drill pads, or pits would be most severe during development and production, possibly reducing nearby vegetative growth and site rehabilitation. Dust that is thick after settling can affect water infiltration, so that rehabilitation becomes even more difficult.

Fish and Wildlife

Each phase of oil and gas activity must be evaluated in terms of the species of fish and wildlife affected, the location of the impact, the timing of the impact, the sensitivity of the species and habitat involved, and the possibility of mitigating each phase early in the review process. The adequacy of baseline data available for each proposal varies throughout the district. Some proposals may require on-the-ground review so that impacts expected from oil and gas activities can be assessed and appropriate mitigating measures can be developed.

Fish and wildlife impacts fall within these major categories:

1. Surface disturbance of the area subject to oil and gas activities. Such disturbance generally reduces the quantity and quality of forage and cover available for wildlife. Reclamation to restore an area's value as wildlife habitat may be difficult or impossible.

2. Displacement of wildlife as a result of disturbance to the area. Displacement could be short-term or long-term, depending on the species involved and the magnitude of the impacts.

3. Stress to wildlife species. This impact would vary with the season during which the activity occurred and the wildlife species involved. Winter and spring are the times during which stress most often occurs.

4. Increased access. Hunting and fishing pressure could increase. Nonconsumptive recreational use of an area (particularly ORV use) could increase, adding to the stress and displacement impacts caused by oil and gas activities. Some of these impacts are caused by workers directly involved in the oil and gas activity.

5. Management problems. Special management provisions might be necessary to close roads and defer livestock use in affected areas. This would add to management costs and enforcement requirements.

6. Noise from equipment associated with exploration and drilling. Wildlife species could be displaced to less suitable habitat by excessive noise. Noise levels exceeding 100 decibels are too high to be acceptable to some wildlife species.

7. Direct mortality to wildlife from the operation of equipment and machinery. Travel on access roads by equipment could result in vehicle-wildlife collisions.

8. Vegetation clearing and soil disturbance along streams for the purpose of access road development. Removal of important vegetative cover and road construction in riparian areas could alter streamflow patterns, raise water temperatures, decrease insect production, and increase siltation levels.

In summary, pad construction, road construction, and the human activity involved with oil and gas production would create the most significant impacts to animals from oil and gas activity. Many of the effects upon wildlife would be indirect effects in that a loss of vegetation (habitat) can result in a loss of forage for animals, or a change in water quality can result in a change in the fish population. Other impacts would be direct in the sense that continued disturbance could result in abandonment of the disturbed areas by wildlife.

Preliminary Exploration

Any road construction can cause a temporary loss of vegetation, which means that less forage is available. Bulldozing activities or heavy vehicle use could destroy bird nesting sites or eliminate valuable habitat for species of limited mobility.

The construction of roads and trails in previously inaccessible areas can create new routes for livestock to follow, so that grazing patterns change. This could cause a change in the vegetative composition of the area previously undisturbed by livestock, and the changed composition could in turn cause a change in wildlife use.

The introduction of livestock to previously unused areas would increase competition with wildlife for forage, water, and space. Road construction and vehicle movement across creeks and streams would temporarily increase the turbidity of the water and, if severe enough, could adversely affect the downstream aquatic fauna.

Many wildlife species are intolerant of increased human activity and associated noises. This can be of extreme concern if it affects a critical period in the life cycle of the species (for example, breeding season) or if critical habitat is affected during periods of use by threatened or endangered species. Similarly, continued activity on or near sharp-tailed grouse breeding grounds or sage grouse strutting grounds could cause the birds to temporarily abandon the areas, so that breeding would be disrupted. Disturbance of sagebrush could be detrimental to sage grouse populations, and disturbance of the vegetation required for sharp-tailed grouse habitat could contribute to population decline.

Exploratory Drilling

In exploratory drilling, intensive human activity could be detrimental to wildlife. The continual use of roads by heavy trucks hauling drilling equipment, water, and work crews would reduce use of the area by some species. The likelihood of gates being left open would increase with increased human activity, and if this happened livestock could cross pastures or allotment boundaries, possibly using forage allocated to wildlife.

If human activity occurred near certain key areas for some species, abandonment would be likely to occur. Examples of such important areas are waterfowl nesting areas, bald eagle and peregrine falcon nests, winter concentration areas for deer or antelope, and grouse dancing or strutting grounds. Construction of drill pads and roads would eliminate some habitat for small mammals, reptiles, and amphibians directly under the area, as well as eliminating the forage for other animals.

Drill site reserve pits contain materials that are toxic to wildlife. Typically, a pit remains open for four to five months. If it is not adequately protected, both domestic and native animals may attempt to use that water, especially on drier range sites. Toxic material from well blowouts or reserve pits may escape and contaminate wildlife habitat. This is especially serious when aquatic habitats are affected. Some wells may produce only water, which may be potable; these wells could provide an important water source for livestock and wildlife.

Development

Effects on animals from development would be similar to those of the exploratory drilling stage, but greater. The magnitude of the increase depends on the size of the oil or gas field. Most established fields range in size from less than 1,000 acres to several thousand, although a few in eastern Montana cover several townships.

Production

The production stage of oil and gas development would probably have the most severe impacts on wildlife because it lasts longer. The major potential impacts on wildlife would result from oil spills and continuous human activity. Pipelines can rupture between the well and the tank batteries. If this occurred, oil would continue to spill until the operator inspected the site. This inspection usually occurs once a day. Spills of several thousand barrels of oil are possible. Vegetation would be destroyed by the oil, and the drainages below the spill could become extremely contaminated. This could severely affect the terrestrial and aquatic wildlife resource.

Twenty pipeline breaks occurred in Montana in 1978; in 11 of these, petroleum products reached state waters. However, cleanup measures such as hot water flushing and immediate skimmer techniques have proved successful if promptly employed. Salt water encountered during oil and gas production can be extremely harmful if spills occur.

Heavy equipment is used during winter to keep oil field roads passable. The volume of traffic created through daily inspection by the field operator would be further increased by local residents and recreationists using those roads. The amount of human disturbance wildlife can withstand varies among species; however, the amount of disturbance any one species will tolerate is lessened during critical stages of its life.

As described for exploratory drilling, noise and vehicle movement near bald eagle and peregrine falcon nesting areas could inhibit nesting success, and continual disturbance in deer or antelope winter range could cause the animals to abandon these crucial areas. Motion and noise near grouse breeding grounds could inhibit their breeding behavior, and disturbances near duck nesting and breeding ponds would probably restrict their breeding behavior or nesting attempts. Excessive disturbance in a crucial habitat of other species would have similar effects.

The extensive system of roads, drill pads, and ancillary facilities associated with a large-scale oil and gas field would eliminate forage production on up to 10% of the land in a given area. This would reduce forage for both livestock and wildlife, necessitating temporary reduction of grazing allocations. Escape and nesting cover for wildlife also would be reduced. However, roads and trails could help to improve livestock dispersal.

Abandonment

The abandonment phase of oil and gas activity results in positive effects for wildlife. Cessation of activity would allow animals intolerant of the activity to return to a normal routine. Revegetation of the well sites and roads would increase the forage available to animals in the area.

The major problem that could occur during abandonment would be unsatisfactory reclamation. Normally, repeated attempts are made until the revegetation effort is successful. Salt water, oil spills, and hydrogen sulfide leaks could make revegetation difficult. Furthermore, if reseeding did not include the primary access roads, they would continue to be used by local residents and recreationists, and this would cause continued disturbance to wildlife.

General Impacts

The animal species in an area depend upon the vegetative type associated with that site; thus, if the vegetative type is known it is possible to predict which animals would be affected. Each of the five phases of oil and gas activity would have some effect on the animals in the vicinity of the activity. Several areas in the district are considered critically sensitive for wildlife. In these areas, the destruction of crucial habitat or the human disturbance associated with oil and gas activity during a critical period of the animals' life could have severe effects.

Studies related to the disturbance of elk and their environment have been directed primarily toward activities associated with logging (Day 1973; Kirsh 1962; Lonner 1974; Marcum 1975). No specific studies have been done on the impacts of oil and gas activities on elk distribution, movements, or habitat use. One instance is reported of elk displacement caused by winter-spring seismic exploration coupled with snowmobile use on known elk winter-spring range (Myers 1978). This activity resulted in the complete displacement of a local wintering elk herd.

Other studies point out the overall impacts of increased access to elk range through road and trail development. The use of these roads alters the security threshold to levels that are inadequate to hold elk because of existing cover patterns, terrain features, or hunter pressure.

The potential impacts on the grizzly bear and its habitat from oil and gas exploration and development are under study in the Rocky Mountain Front region (refer to Border Grizzly Research Contract #YA-512-CT7-201). A less intensive inventory was completed by the Interagency Study Team for the Centennial Mountain Range.

The adapability of grizzly bears to the cumulative impacts of various activities, such as oil and gas exploration and development, or to commercial developments (subdivisions, livestock grazing, timber harvesting, road development and maintenance, noise, and other offsite impacts) is not well understood, but it is critical to the survival and future welfare of the grizzly bear in Montana. Studies to date indicate that the grizzly bear is sensitive to these disturbances, and the future survival and welfare of the grizzly will be enhanced by minimizing human impacts on occupied habitat.

Studies of grizzly bears in the Swan Hills region of Alberta identified dump areas as a major attractant to bears (Nagy and Russell 1978), as did studies in Montana (Schallenberger and Jonkel 1980). Reclamation of roads and pipeline rights-of-way in Alberta with a grass-sweet clover mixture led to significant use of those areas by both grizzlies and black bears. The attraction of bears to the lush green forage of succulent grasses and forbs (yellow sweet clover) contributed to this increased use. The study also acknowledged that large numbers of resident grizzlies were either displaced or killed during early phases of development.

Impacts to black bears from oil and gas exploration and development activities would include loss of habitat from surface disturbance through road and trail development, attraction of bears by garbage dumps within their habitat, unneccessary (illegal) killing of bears as a result of bear-human encounters, noise impacts to bears from the operation of equipment and vehicles, and possible vehicle-bear collisions on bear travel corridors and feeding areas. Helicopter activity could cause displacement of bears onto areas occupied by humans.

Endangered species habitat is considered critically sensitive because limited habitat is available for preservation of the species. Such habitat includes eagle nesting and wintering areas and peregrine falcon eyries. Human disturbance at eyries can be a serious problem, especially during nesting season; the falcon will usually abandon its nesting attempts when harassed. Some peregrines will refuse to breed if humans have been anywhere near their eyries.

General big game winter ranges are considered sensitive throughout the entire district. Big game winter concentration areas are considered critically sensitive since they represent the limited areas where food and cover are available during severe winter conditions.

Sharp-tailed grouse dancing grounds and sage grouse strutting grounds are considered critically sensitive because of their importance to reproduction and to the general survival of the local population.

A loss of mountain grouse habitat could result from road and trail development, which could cause surface disturbance and loss of cover and forage plants. Other impacts to mountain grouse could be noise disturbance, especially during the nesting period (May-June), possible vehicle-bird collisions when vehicles travel through mountain grouse habitat, possible illegal shooting of mountain grouse, and pollution of mesic (wet) sites from oil spills and human activities. The most significant impact would be the change in availability of cover and food plants that are essential for mountain grouse.

Bighorn sheep habitat is considered sensitive because habitat in the district is limited. Geist (1975) found that human disturbance caused sheep to vacate their accustomed areas. If disturbance occurred on wintering habitat, it could result in relocation of the local population, perhaps to an area in which their chances of survival are lower.

Impacts to Rocky Mountain goats would include physical disturbance of the habitat from roads and trails, noise from exploration and drilling activities and from vehicles, and disturbance to key use areas such as foraging and bedding areas. Helicopters used for exploration activities could cause stress on mountain goats.

Riparian habitat associated with major rivers and drainages is extremely valuable because no other vegetative community is as capable of supporting such a variety of species or such a large number of animals. Important game species such as white-tailed deer and ring-necked pheasants depend almost totally on riparian vegetation for their year-round food and cover requirements. Furthermore, riparian habitat provides seasonal habitat for nesting birds and wintering mule deer in some areas. Many furbearing mammals found in the study area are associated with major waterways and the surrounding vegetation, and wintering areas for bald eagles are found along major streams. Riparian areas are considered sensitive because of the high density of animals found in these areas and the relatively limited amount of riparian habitat found within the study area.

LAND USES

Recreation

Oil and gas activity would cause various degrees of impact on recreation resources, depending on location, time of year, and phase of activity. Increased secondary impacts to some urban centers could occur if population increased significantly. These impacts to urban centers and outdoor recreation would occur in direct proportion to population increases associated with the five phases of oil and gas activity.

A variety of recreation opportunities available in the Butte District conflict to some degree with oil and gas activity. The impacts of oil and gas activities tend to reduce the availability of undeveloped recreation, and both the quality of the experience and the number of opportunities could suffer. Certain specific recreational activities may benefit, but participants in these activities generally already have a variety of places to use.

Conflicts during particular times of the year and within particular areas can be expected. Developed, undeveloped, and primitive recreation areas are used mostly during the summer and fall. Areas designated under the off-road vehicle regulations are primarily seasonal, and this limits oil and gas activity to the times of the year specified in the designation. Areas closed to all but over-the-snow vehicles would further limit this activity in

some cases, as all activities would be subject to the restrictions required by the closures.

Recreation sites, especially developed sites and heavily used undeveloped sites, could be affected by oil and gas activities in the near vicinity. Travel zones could be adversely affected by oil and gas activity adjacent to or within sight of roads and trails. Significant recreation sites and management areas are identified on the Recreation map.

Preliminary Exploration

Preliminary exploration often involves operations that affect recreation, such as off-road travel, low standard road and trail development, truck-mounted seismic units, explosive charges, and a number of additional operations that have minimal onsite impacts on recreation.

Increased roads, trails, or tracks in road closure areas and adjacent to recreation sites could encourage violations of travel restrictions. Although the site-specific impacts might not be significant, the cumulative effect of large-scale oil and gas exploration, with its accompanying roads and trails, could effectively eliminate some unroaded areas that provide undeveloped recreation opportunities on public land. Heavier use pressures could occur on these lands as the access became easier. The presence of people and equipment during hunting season would have the initial effect of dispersing wildlife from the immediate area, thus reducing or eliminating hunting opportunities.

The development of low standard roads could make more opportunities available for off-road vehicles, particularly motorcycles and four-wheel drives. In timbered areas at higher altitudes, the roads could benefit snowmobiles, because more routes would be available. Additional roads also could cause a change in the type of recreation use.

Exploratory Drilling

Exploratory drilling involves more surface disturbance and thus has a higher impact on recreation than does preliminary exploration. Temporary roads generally are constructed to a higher standard than roads used for preliminary exploration. The disturbed area of the drill pad, mud pits, and various equipment is usually about 2 to 4 acres.

Higher standard roads reduce opportunities for recreationists who prefer the more undeveloped forms of recreation. In some cases, the roads encourage motorzed vehicle uses that contribute to greater possibility of damage to cultural resources, increased hunting pressure, and increased violation of road closures. The short-term impacts of increased traffic, dust, and noise from the drilling programs, coupled with the presence of people and equipment, may eliminate the opportunity for some forms of recreation and reduce the quality of other forms. Developed hiking and horse trails may be superseded by roads.

New access can encourage more ORV use in adjacent areas. This means the disturbed area may end up much larger than the area originally impacted by oil and gas exploration.

Exploratory drilling during hunting season would have more potential for dispersing wildlife; a site so affected would be less suitable for hunting. Oil spills or leakage from mud pits near rivers or streams could adversely affect water-based recreation because of aesthetic factors such as odor, surface contamination, or destruction of fish or waterfowl.

The higher quality roads would provide greater motorzed access for camping, picnicking, hunting, and other general recreational activities in previously remote areas, and sightseeing could increase because people might be curious about the oil and gas operation.

Development and Production

Development and production would further reduce an area's suitability for recreation because additional wells would be drilled, roads would be upgraded, and concentrations of equipment would interfere with recreational pursuits. Hiking and horse trails could be eliminated by roads, and road closure violations might increase.

Hunting opportunities would be affected, since the presence of noise, people, and equipment would disperse elk, mule deer, and, to a lesser extent, antelope. Recreation on surrounding lands also could be affected by noise and odor pollution. Sightseeing could benefit slightly, as people may want to observe a working oil and gas operation. Production leads to fairly high standard roads, which could increase access to the area.

Abandonment

In timbered or mountainous terrain, the effects of development would still be apparent after abandonment. ORV uses could continue on roads and reclaimed roadways, and this would adversely affect activities usually carried out in unroaded areas.

Wilderness

In areas that have wilderness characteristics, all oil and gas leases issued since the passage of FLPMA (October 21, 1976) are subject to the nonimpairment criteria found in the *Interim Management Guidelines for Lands under Wilderness Review*. Thus, oil and gas activities must be conducted in a manner that will not impair the suitability of these areas for preservation as wilderness. These restrictions will apply until Congress decides which areas, if any, should be designated wilderness.

Oil and gas activities on leases issued before FLPMA are not subject to the nonimpairment criteria for wilderness; they are subject only to regulations preventing unnecessary and undue degradation of lands and nonwilderness resources. Therefore, some wilderness values may be lost through development in pre-FLPMA lease areas. However, many of the standard stipulations developed for the protection of nonwilderness values and resources may result in mitigation of impacts to wilderness values as well. One such stipulation is the requirement that disturbed areas must be rehabilitated.

Visual Resources

To protect and manage scenic values, visual quality objectives are established by the BLM for each scenic quality class relative to visual sensitivity and visual distances. Then visual resource management (VRM) classes are established for each visual quality objective relative to visual absorption capability of the landscape, based on steepness of slope, density of vegetation, and color contrast of soil. VRM classes are defined below.

Class I: Only natural ecological changes to the landscape or very limited management changes are to be allowed.

Class II: Changes should not be evident in the characteristic landscape; that is, a contrast may be seen but should not attract attention.

Class III: Changes may be evident and attract some attention but should remain subordinate to the characteristic landscape.

Class IV: Changes may attract attention and be a dominant feature in the landscape in terms of scale; however, they should blend as much as possible with the characteristic landscape.

The following relationships exist between scenic quality classes and VRM classes in the Butte District. (Scenic quality classes are shown on the Visual Resources map.)

Class A: Generally will be managed Class II, except for special management areas such as wilderness and natural areas or areas of low visual absorption capability, which will be managed Class I.

Class B: Generally will be managed Class III, except for those areas with low visual absorption capability and/or high visual sensitivity, which will be managed Class II.

Class C: Generally will be managed Class IV, except for those areas with low visual absorption capability and/or high visual sensitivity, which will be managed Class III.

The following is a discussion, by phases of oil and gas activity, of anticipated impacts to the visual resource.

Preliminary Exploration

Class A Lands. Some significant adverse impacts could occur during preliminary exploration because of short-term evidence of vegetation clearing and soil disturbance. In areas managed Class I, significant adverse impacts would generally be unavoidable, as these modifications are not natural/ecological ones.

Class B Lands. Moderate adverse impacts could occur during preliminary exploration from short-term dominance of the landscape by the modifications mentioned previously. In areas of low visual absorption capability and/or high sensitivity (managed Class II), more significant adverse impacts could be caused by evidence of these modifications.

Class C Lands. No significant adverse impacts should occur during preliminary exploration, as the modifications generally can blend with the landscape. In areas of low visual absorption capability and/or high visual sensitivity (managed Class III), some moderate adverse impacts could be caused by short-term dominance of the landscape by these modifications.

Exploratory Drilling

Class A Lands. Significant adverse impacts could be caused by short-term evidence of vegetation clearing, soil disturbance, and the drilling structure. In areas managed as Class I, significant adverse impacts would generally be unavoidable, as these modifications are not natural/ecological ones.

Class B Lands. Moderate adverse impacts could be caused by short-term dominance of the landscape by vegetation clearing and soil disturbance. Significant adverse impacts could also be caused by short-term dominance of the landscape by the drill rig structure. In areas of low visual absorption capability and/or high visual sensitivity (managed Class II), more significant adverse impacts could be caused by vegetation clearing, soil disturbance, and drill rigs.

Class C Lands. No significant adverse impacts should occur from vegetation clearing and soil disturbance. Moderate adverse impacts could occur because the drill rig structure would not blend, but the structure also could add variety and interest to the landscape. In areas managed as Class III, more significant adverse impacts could occur.

Development

Class A Lands. Significant adverse impacts could be caused by long-term evidence of the proliferation of structures and by extensive vegetation clearing and soil disturbance. In Class I areas, significant adverse impacts would generally be unavoidable, as these modifications are not natural/ecological ones.

Class B Lands. Moderate adverse impacts would be caused by long-term dominance of the landscape by these modifications. In areas of low visual absorption

capability and/or high visual sensitivity, some significant adverse impacts could be caused by long-term evidence of these modifications.

Class C Lands. No adverse impacts should be caused by vegetation clearing and soil disturbance; however, moderate adverse impacts could occur because the structures may not blend with the landscape or add acceptable variety. In areas managed Class III, moderate adverse impacts could be caused by long-term dominance of these modifications.

Production

Class A Lands. Significant adverse impacts would be caused by long-term evidence of oil production structures, and some significant adverse impacts also could be caused by long-term evidence of gas structures. In areas managed Class I, significant adverse impacts would occur for either oil or gas because the modifications are not natural/ecological ones.

Class B Lands. Significant adverse impacts could be caused by long-term dominance of the landscape by oil modifications, and moderate adverse impacts would be caused by long-term dominance of the landscape by gas modifications. In areas managed Class II, significant adverse impacts could be caused by long-term evidence of both oil and gas modifications.

Class C Lands. Moderate, long-term adverse impacts would occur because oil modifications would not blend, and some moderate long-term adverse impacts could occur because gas modifications would not blend. In areas managed Class III, some significant adverse impacts could occur from long-term dominance of the landscape by both oil and gas modifications.

Abandonment

Class A Lands. Moderate adverse impacts during abandonment of the first two phases of oil and gas activities could be caused by short-term evidence of the reclamation. Some significant adverse impacts could be caused during abandonment of the last two phases by long-term evidence of reclamation. However, reclamation of any phase generally would be better than the modifications.

Class B Lands. Beneficial impacts should occur for abandonment of the first two phases, and moderate adverse impacts could occur for the last two phases. In areas managed Class II, the statement for Class A lands would apply.

Class C Lands. Beneficial impacts should occur for all phases. In areas managed Class III, the statement for Class B lands would apply.

Cultural Resources

Any surface-disturbing activity has the potential to affect historical, archeological, and paleontological features. The exact impact of oil and gas leasing on such features cannot be determined in advance because the Butte District's cultural resource inventory is limited and the areas of future oil and gas development are unknown.

Standard lease stipulations require that cultural resource inventories be completed before surface-disturbing oil and gas activities are begun. Furthermore, the BLM must be notified if surface disturbance results in the discovery of previously uninventoried cultural resources. Thus, oil and gas activities may, in some cases, provide new information, in effect having a positive influence on our knowledge and understanding of cultural resources.

The primary negative impacts to cultural resources would be the removal or obliteration of features and artifacts, and disturbance to the area around them. The context or the relationship of the location of the artifact to the soil depth and other nearby artifacts, buildings, and fire hearths provides many of the clues to cultural resource interpretations. Thus, any surface disturbance, from natural erosion to earthwork for a road, disturbs the context to some degree and may destroy the integrity and value of the cultural resource.

The following impacts to cultural resources are separated by phase.

Preliminary Exploration

The early stages of geophysical exploration could involve ORV travel. This could cause an increase in access to a previously remote area, possibly resulting in increased artifact collecting or additional surface disturbance.

The second phase of preliminary exploration is seismic work. If no roads were built, then most impacts would be similar to the ORV use discussed above. An additional impact would come from disturbance resulting from surface blasting. The blading of roads or trails along the seismic route would result in a more permanent route and cause additional surface disturbance. In addition, new remote areas could be opened up, possibly leading to increased illegal artifact collecting.

Exploratory Drilling

More permanent roads generally are established during exploratory drilling. Illegal artifact collection could increase because of this.

Construction of drill pads could result in the complete destruction of any cultural resource on or close to the surface and might disturb even fairly deep deposits. Ground cover and soil development might hinder the detection of cultural resources from surface evidence,

and it is doubtful that the heavy equipment operator would be able to recognize any subsurface cultural resource; therefore, some cultural resources could be destroyed without ever being detected.

Development and Production

Additional roads and drill pads probably would be constructed, resulting in impacts similar to those described earlier. Any facilities necessary to develop the field could further disturb cultural resources. These include powerlines, pipelines, in-field collection lines, tank batteries, compressor plant stations, water treaters, and additional access and maintenance roads. Depending upon the spacing, the development of a major field could result in the disturbance of a significant area.

Abandonment

The abandonment of the field or a well might not mean the end of the impacts to cultural resources, because the use of roads and access trails by other land users could continue after abandonment.

THE SOCIOECONOMIC ENVIRONMENT

Economic and Social Conditions

With the existing major distribution systems for gas and oil, and the regional oil refinery network, it is unlikely that any facilities will be built in the district other than those for extraction and transportation.

The greatest impact on social and economic conditions would occur during large field development. Such impacts would be centered in communities near oil and gas development and would be the result of the influx of people attracted by employment opportunities. Communities in the area vary greatly in their ability to absorb sizable population increases without major changes in the quality of life. Population increases would increase housing needs and might place a burden on the community infrastructure, including water supply, sewage treatment, schools, recreational opportunities, and police and fire protection.

Only two counties in the Butte District, Pondera and Teton, currently have producing oil and gas areas. Most of the activity in those counties occurred in the 1920s and 1930s. Since no major fields have been fully developed in the area in the recent past, direct and indirect employment observed in the late 1960s in the Bell Creek field in southeastern Montana will be used. Employment levels and population increases will not be significant for other phases of oil and gas activity. Direct employment at Bell Creek was 190 and indirect employment was 173.

Other assumptions made for this analysis are that 50% of the workers would be married and that 50% of those married workers would bring their families with them. It is also assumed that most of the direct employment would result in an immigration of population, while most of the indirect employment opportunities would be filled by the local population.

If 3.5 persons per family is used as an average, an increase of 310 persons in the local population could be expected. In some counties with small populations and low unemployment rates, population increases might be higher, since more jobs would be available than the local work force could fill. Table 2-2 shows the levels of employment and unemployment by county in 1978.

Types of housing chosen by workers would depend on the stock of available units, the length of time workers would expect to be in the area, and the opportunities for construction of houses or the space for mobile homes. The quality and mix of units might not meet the demand for housing well, but at the present time it is difficult to determine the size of this problem accurately.

On the basis of the assumption of direct population and employment increases, it is possible to estimate a community's general sensitivity to such increases. Table 2-3 shows the percentage of increase in area population with an influx of 310 people and the percentage of increase in employment with an increase of 190 jobs. Areas showing a 20% or greater increase in population over four to six years are considered to be significantly affected. From the available information, the communities that would have the most significant increases are also the ones least able to absorb such increases. Many of these communities lack hospital facilities and surplus school capacity. The adequacy of other infrastructure items is not known, but it is likely that they also would be inadequate to meet a significant population increase.

The development and production phases would increase the tax base for the counties and provide increased revenue for the state. Expenditures by seismic and wildcat drilling crews would be a short-term economic benefit to small communities. Seasonally, this could be a problem, as when these crews and hunters compete for limited lodging and eating facilities.

Oil and gas exploration and development could greatly increase the maintenance needed for county roads. Continuous travel by heavy trucks on gravel roads and light-duty paved roads can cause maintenance costs to increase, and maintenance needs could exceed the capabilities of existing personnel and equipment in the affected counties. Damage to bridges and cattleguards also could be expected.

TABLE 2-2

EMPLOYMENT AND INCOME SUMMARY

County	1979 Employed (thousands)	1979 Unemployed (thousands)	1978 Per Capita Personal Income	Rank
Beaverhead	3.9	0.2	$ 6,786	22
Broadwater	1.5	0.1	6,635	28
Cascade	31.9	2.1	7,134	15
Deer Lodge	5.0	0.4	6,436	31
Flathead	22.1	1.6	6,906	19
Gallatin	18.7	0.8	6,247	35
Granite	1.0	0.1	6,147	38
Jefferson	2.1	0.2	4,610	56
Lake	7.7	0.5	5,125	53
Lewis and Clark	23.0	1.2	8,052	5
Lincoln	6.4	0.7	5,954	41
Madison	2.3	0.1	5,400	50
Meagher	1.0	*	6,680	26
Minerals	1.6	0.1	5,520	48
Missoula	34.3	2.3	7,224	14
Park	5.6	0.3	6,209	36
Pondera	3.4	0.1	7,522	10
Powell	3.2	0.2	6,612	29
Ravalli	7.5	0.6	5,362	51
Sanders	3.5	0.3	5,635	47
Silver Bow	16.9	1.1	6,964	17
Teton	2.7	0.1	7,984	7
Montana	351.0	19.0	6,915	--

SOURCE: Montana Business Quarterly, Spring 1981.

* Less than 51 workers.

TABLE 2-3

PROJECTED DIRECT IMPACTS TO POPULATION AND EMPLOYMENT
FROM MAJOR FIELD DEVELOPMENTS

County/Community	Percentage of Population Increase[a]	Percentage of Employment Increase[b]
Beaverhead	3.80	5.00
Dillon	7.80	
Lima	114.00	
Broadwater	9.50	16.40
Townsend	19.50	
Cascade	0.38	0.61
Great Falls	0.54	
Deer Lodge	2.50	4.80
Anaconda	2.50	
Flathead	0.60	0.97
Kalispell	3.00	
Whitefish	8.70	
Gallatin	0.70	1.10
Bozeman	1.40	
Granite	11.50	8.60
Drummond	75.60	
Philipsburg	27.40	
Jefferson	4.40	8.90
Boulder	21.50	
Whitehall	29.80	
Lake	1.6	2.9
Polson	10.9	
Ronan	20.3	
Lewis and Clark	0.70	0.80
Helena	1.30	
Lincoln	1.70	3.60
Libby	11.30	
Madison	5.70	9.60
Ennis	46.90	
Meagher	14.50	20.70
White Sulphur Springs	23.90	
Mineral	8.40	11.70
Alberton	81.80	
Superior	29.50	
Missoula	0.40	0.60
Missoula	0.90	
Park	2.40	3.80
Livingston	4.40	
Pondera	4.60	5.90
Conrad	10.10	
Powell	4.50	5.70
Deer Lodge	7.70	
Ravalli	1.40	3.10
Hamilton	11.70	
Sanders	3.60	5.60
Plains	28.80	
Thompson Falls	21.10	
Silver Bow	0.80	1.10
Butte	0.80	
Teton	4.80	7.80
Choteau	17.30	
22 Counties	0.06	0.09
Montana	0.04	0.06

a. A population influx of 310 people is assumed.

b. An addition of 190 people to the labor force is assumed.

THE ROCKY MOUNTAIN FRONT

The discussion of impacts in the preceding pages applies to the resource values in the Rocky Mountain Front. Potential impacts special to the Rocky Mountain Front relate primarily to the grizzly bear and to wilderness values. This area is not as highly developed as many other parts of the district, so activities here can have a more serious effect on the existing situation than they would have in other areas.

Recent experience with several seismic and drilling proposals indicates that the cumulative impact of a series of actions in a drainage or other local area is the most serious threat to grizzly bear use and wildlife habitat in general. Development activities in areas being studied for wilderness can change the wilderness potential of the area or adjacent areas.

Impacts can be magnified if all the various land managing agencies in the area permit activities without considering the cumulative impacts. The relationship of different activities in time and location also is a major factor in the degree of impacts. Two drilling operations within a few miles of each other might have much greater impact if conducted simultaneously than they would if the timing was staggered.

MITIGATING MEASURES

This section describes measures that would reduce or eliminate negative impacts resulting from oil and gas activity. The geographic scope of this assessment makes it extremely difficult to prescribe mitigation on a site-by-site basis. Consequently, many of the mitigating measures described would not apply to all sites. Instead, the measures apply to areas that exhibit environmental features sensitive to oil and gas activity (for example, fragile soils or endangered species). Application of mitigating measures occurs at two points in the process: when an application for lease is received and when specific operations on the lease are proposed.

When a lease application is received, district specialists review the resource data contained in various land use plans and inventory summaries. Field reviews are conducted if necessary, and a leasing checklist is completed (see Appendix 2). Where potential impacts that could result from oil and gas operations are identified, special stipulations are applied to the lease. The lessee must accept these stipulations before the lease is issued.

The special stipulations are used in addition to the standard stipulations on the lease form and those attached to all leases issued by the BLM in Montana. Appendix 3 contains the standard stipulations that have been worked out by the BLM and the GS.

Appendix 4 contains special stipulations that may be used to address site-specific resource problems. These special stipulations cover most of the normal impacts expected from oil and gas activities in Montana. Additional special stipulations can be written to cover any unique situation on a particular lease. When additional special stipulations are proposed, they are reviewed and approved by GS before they are included in the lease. If an applicant feels that the stipulations are unwarranted, administrative and judicial appeal processes are available. If no significant impacts are anticipated, only the standard stipulations will be used.

The use of the multi-resource checklist (Appendix 2) will ensure that all resource values are considered. The review process makes maximum use of existing data, supplemented by field review where specific data are lacking. This process also allows for other agency input where split-estate lands are involved. Particular emphasis is placed on split-estate lands of which the surface is managed by the MDFWP.

The objective of impact mitigation at the leasing stage is to identify major areas of impact and put the lessee on notice about major restrictions that will affect the use of the lease.

The second type of mitigation is more site-specific; it is carried out where specific operations are proposed on the lease area. This occurs at each phase of operation. Impact mitigation of this type can be much more precise than that carried out during leasing, because the lessee can spell out the location of operations within the larger area. In developing mitigating measures for each proposal at this stage, we will consider the cumulative impacts of previous development in the area.

At the preliminary exploration phase, the operator must file with the BLM district manager a notice of intent to conduct seismic operations. In responding to these notices, the district manager may limit or restrict certain operations to protect surface resource values.

In the exploratory drilling phase, the lessee or operator must notify the BLM of his/her intent to stake a well. A review is made to determine any impacts that would require moving the well or access roads or otherwise modifying the exploratory drilling operations. The lessee then files an APD, which is reviewed by the BLM and the GS to determine site-specific stipulations. A separate environmental assessment is prepared by the GS at this time unless the proposed action can be categorically excluded from further NEPA review.

Should development and production occur, additional operating plans must be filed for review. Review and environmental analysis of these plans provide a further opportunity for applying needed mitigating measures, as discussed in this section. Abandonment requires similar plans for rehabilitation and other work. All available techniques will be used for proper reclamation of disturbed areas.

Further details of surface operations and procedures for mitigation are described in *Surface Operating Standards for Oil and Gas Exploration Development,* published by the BLM, the GS, and the Forest Service. Copies are available from all three agencies.

In this section, each component suggests mitigating measures designed to eliminate or reduce impacts to that particular component. This range of protective measures will then be considered at the time of lease or

during the predrill inspection so that the resource values found within a specific lease area can be protected.

Special stipulations limit the lessee's normal enjoyment of the lease. Examples are when portions of the lease cannot be occupied or cannot be used during certain parts of the year becaue of wildlife or watershed values, when certain roads cannot be used, or when special situations requiring unique or unusually expensive steps by the lessee are evident at the time of lease issuance. Special situations could involve extremely unstable formations, community water sources, or identified critical habitat for threatened or endangered species.

Stipulations for normal situations will be covered during the lease development stage in the APD and the Multipoint Surface Use and Operations Plan required by NTL 6 (Chapter 1, Section 1.4, "Operations"). Some of the normal situations covered in this manner are access road location, design and construction, materials for construction, drill site development, layout and construction of facilities, waste disposal, water supply, protection or recovery of cultural resources, proper engineering techniques, visual resource considerations, steps necessary for quick and successful reclamation, wildlife habitat protection, and required soil or water testing.

Methods of seedbed preparation and seed mixtures can be left open until the actual rehabilitation operation is begun; however, where special needs are anticipated (hard-to-find native seed, special seedings, or tree or shrub planting), it should be stipulated at the time of approval of the APD.

The need for using special stipulations must be supported in this assessment or by the inclusion of the rationale with the recommendation for use of the stipulations on a lease. This documentation will be included in the lease file and will consist of a completed checklist and supporting rationale.

Some of the following mitigating measures are proper for use at the time of lease; others should be applied during the APD period.

THE PHYSICAL ENVIRONMENT

Geology

Localities with known vertebrate paleontological sites should be protected by a "no occupancy" stipulation. This can be covered in the special stipulations recommended by the district geologist or surface protection specialist.

When vertebrate paleontological features are uncovered at any stage of oil and gas activity, they should be left intact and reported to the district manager or to the GS district engineer.

Areas with existing mines or mining permits should be avoided. This can be covered in the special stipulations issued by the district geologist or surface protection specialist.

Soils

Standard lease terms restrict oil and gas activities from causing or contributing unnecessarily to soil erosion, crop damage, and loss of forage and timber productivity, because the lease requires the use of reasonable steps to prevent damage. These terms also protect natural surface resources and improvements.

Oil and gas expioration and drilling could be restricted during muddy and wet periods to minimize soil and watershed damage in areas exhibiting high sensitivity to these activities. Such a limitation would not normally apply to the maintenance and operation of producing wells, which typically are served by permanent all-weather roads.

Seasonal and slope limitations could be placed on occupancy, drilling and storage facilities, and other activities. This would allow for reduced erosion. Because impacts are greater on steeper slopes, a standard stipulation requiring no surface occupancy on slopes of more than 30% is applied to all leases in the district. In fragile or unstable soil types, this may be applied to slopes of more than 20%.

Roads should be constructed with adequate specifications to ensure proper grade and drainage. Culverts should be placed at appropriate locations to maintain existing stream channels.

Development could be designed to conform to existing topography. This would minimize the amount of earthwork needed.

Soil compaction by vehicular traffic could be reduced by ripping, harrowing, plowing, discing, or other mechanical means after the cessation of operations. Such measures would increase the movement of water, air, and nutrients within the topsoil to near normal levels.

Soil horizon mixing could be minimized by stockpiling suitable topsoil material separate from less desirable material.

Following grading and construction, the disturbed areas could be revegetated with appropriate plant species wherever such action would not interfere with the constructed facilities and their operation.

Mulches and soil stabilizers could be used where practicable and necessary to retard wind and water erosion until revegetation became established.

Storage tank areas could be graded so that drainage would be away from the tanks and toward drainageways to the holding basins. This would minimize the effects of oil and fluid spills.

Pipeline routes and access roads could avoid areas of low rehabilitation potential and high slope failure potential.

Borrow pits and borrow areas generally should be located away from existing roads and public use areas. Borrow areas should be stabilized and revegetated after use.

Suitable topsoil material could be stockpiled and vegetated for later use in site rehabilitation. The depth of suitable topsoil will vary from site to site. Soil stockpiles should be protected from wind and water erosion.

Waste pits, reservoirs, and mud pits should be lined when they are in permeable soils, so that mud and toxic materials do not enter soils and water tables. Reserve and waste pits help reduce spills and contain drilling muds and formation fluids.

Oil spills, drilling fluids, and other contaminants should be channeled to holding basins for retention and treatment prior to release into the watershed.

Water

Area or district personnel could examine geophysical lines both before and after completion, by overflights or on-the-ground examination.

In areas where the slope is greater than 20%, the district surface protection specialist should consult with the soil scientist and make appropriate recommendations before geophysical work begins.

In areas where a geophysical line is to cross an ephemeral stream channel with a drainage greater than 10 square miles above the proposed crossing, the district surface protection specialist should consult with the hydrologist and make appropriate recommendations. In all cases, reasonable attempts should be made to minimize drainage crossings.

The detonation of explosives used in geophysical exploration should not be allowed within 500 feet of any well or spring.

At major drainage crossings, operators should install appropriate culverts or other devices that can handle a 50-year runoff event. Low water crossings may be preferable in areas with clayey soils, since culverts are difficult to retain in these soil types.

Where necessary, temporary stream stability structures could be required, especially where access roads cross stream channels and along steep cutbanks and fill slopes near stream channels.

Long-term occupancy should not be allowed on 100-year floodplains unless measures can be taken to minimize impacts during flooding (for example, containment of drilling mud in tanks, construction of flood-retention dikes, storage of hazardous materials above flood level).

Surface occupancy should not be allowed on any wetland, within dedicated municipal watersheds, or in the vicinity of domestic water wells unless measures can be taken to minimize or eliminate impacts. Special stipulations should be formulated to protect any public water supplies.

Drill pad construction work generally should not be allowed within 300 feet of ephemeral stream channels with a drainage area greater than 10 square miles, or within 500 feet of all perennial stream channels. The approval of the district manager should be required for any exceptions, with recommendations from the district soil scientist, hydrologist, and fisheries biologist when appropriate.

Stream stability structures should be required at all stream crossings by permanent roads where drainage areas are greater than 10 square miles.

All evaporation ponds should be diked and not subject to runoff from drainages. Fill material should be adequately compacted. One-half of the pond structure should be cut into original ground level.

Mud pit fluids could be pumped from the pit, and rehabilitation should take place as soon as possible. Such measures should be required in cases where the pit site could affect perennial water courses. This would depend upon the site's soil and drainage characteristics.

THE BIOLOGICAL ENVIRONMENT

Vegetation, Range, and Forestry

Limitations on the use of earthmoving equipment and on vegetation removal can eliminate excess destruction of vegetation. The impact to vegetation from roads can be mitigated by allowing temporary roads to be constructed only to the minimum necessary width.

Locations of roads must be planned to avoid unnecessary duplication. If possible, roads should be located so as to be advantageous to later resource management needs such as the removal of forest products in commercial forest areas.

Where possible, drill sites should be located in areas of lower value vegetation. Special forest areas identified for the production of superior tree seed should be avoided.

Accumulation of slash on disturbed sites can be mitigated by burning or burying of residues. Soil stipula-

tions should be designed to complement vegetation stipulations. Stipulations pertaining to productive forestland should be considered if lease areas would affect the commercial timber base.

Destruction of vegetation, loss of site productivity, and interference with range or forest management programs during oil and gas physical activities can be further mitigated by the following measures:

Restricting the use of bulldozers in seismograph operations.

Constructing dikes around all facilities that generate or store contaminants.

Maintaining all improvements in a serviceable and safe condition, including fences, gates, cattleguards, roads, trails, pipelines, bridges, water developments, and control structures.

Lining reserve pits to prevent contamination of groundwater or soil.

Installing waterbars, terraces, or diversion ditches on the uphill sides of facilities or in other areas where excessive runoff and erosion are anticipated. Establishing rehabilitation requirements, including revegetation with native species, installation of mechanical erosion control devices, removal of foreign material, and scarification of sites with compacted soils. Where necessary, disturbed areas should be fenced to prevent livestock grazing until vegetation is established.

Fencing and flagging mud, separation pits, and other hazardous materials to prevent access by humans, livestock, waterfowl, and wildlife.

Developing contingency plans for controlling spills or leaks.

Notifying the BLM grazing lessee or permittee of the approximate starting and completion dates for oil and gas activities.

Fish and Wildlife

General Measures

The following measures would reduce the impacts of oil and gas exploration activities on fish and wildlife and their habitat.

Seasonal or, when necessary, permanent no-occupancy stipulations should be applied within 1/4 mile of lands that are considered essential habitat for threatened or endangered species. The Endangered Species Act (1973) forbids disturbance of essential habitat where such disturbance would jeopardize the existence of endangered species. This would include grizzly bear habitat, northern Rocky Mountain wolf habitat, peregrine falcon eyries, and active bald eagle nests and wintering areas found in the district. The bald and golden eagles are further protected by the Bald Eagle Protection Act, which prevents the "taking" of eagles. The term "taking" refers to pursuit, shooting, poisoning, wounding, killing, capturing, trapping, collecting, molesting, or disturbing (Bald Eagle Protection Act 1973, Sec. 668C).

Timely inventories and studies should be conducted to document threatened and endangered species and their habitats. Informal or formal consultation with the USFWS is required where threatened and endangered species are involved. All approved leases will carry a stipulation to protect any endangered or threatened species (see form 3100-47, Appendix 3).

Seasonal or yearlong no-occupancy stipulations should be applied to protect essential habitat of other sensitive species such as sharp-tailed grouse dancing grounds, sage grouse strutting grounds, or wintering areas for either species.

Oil and gas activities should not be allowed in nesting areas associated with grouse breeding grounds between March 15 and June 15, so that disturbance to grouse during the breeding and nesting seasons can be minimized.

Seasonal or, where necessary, permanent no-occupancy stipulations should be applied in areas considered critically sensitive for bighorn sheep.

Seasonal use restrictions should be applied on big game winter range areas.

No-occupancy stipulations should be applied within 500 feet of critically sensitive waterfowl nesting areas.

Oil and gas activities should not be allowed within 100 feet of areas considered critically sensitive riparian habitat.

A field development plan, including a plan for the road system in an oil field production area, is required under current federal standards for oil and gas surface operations. Such a plan serves to minimize the effects of vegetative loss due to road construction and the consequent effects upon wildlife. Under this type of plan, one major road through the field with adequate (depending upon truck size) spur roads to well sites would eliminate the haphazard maze of roads and trails through the field. Right-of-way clearing should be kept to a minimum, particularly where important wildlife browse and cover species are involved. This would reduce the acreage of vegetation lost; consequently, more forage would be retained for wildlife.

To prevent wildlife from using the toxic water contained in the reserve pits, lease specifications could require that these pits be fenced and covered with lightweight netting until they are emptied.

In the production stage of oil and gas development, the operator usually inspects each well site daily. During winter, a critical period for many wildlife species, the

operator's activity could be limited to the hours of 9 a.m. to 3 p.m. in general big game winter range areas.

Cattleguards or gates could be installed on all permanently constructed roads to keep livestock from crossing to other pastures.

Blasting, helicopter surveys, equipment operation, and other activities should be timed to avoid periods critical to wildlife species in the affected area. Noise should be kept at levels acceptable to wildlife in sensitive areas. Noise-suppressing devices should be installed to reduce noise caused by the operation of machinery and equipment. Equipment should be properly maintained in order to reduce noise levels.

Where sensitive wildlife species could be affected, minimum flight elevations should be considered for helicopters and other aircraft used during exploration, surveying activities, and agency compliance work.

During wet periods of the year, roads to exploratory drill sites should be surfaced and/or periodically graded so that they remain passable. This would eliminate much of the off-road travel that occurs around drill sites, and surface disturbance would be reduced.

Low speed limits may be required in areas where vehicle-wildlife collisions could occur. Reducing vehicle traffic during early morning and evening periods (when wildlife are more active) would also reduce vehicle-wildlife encounters. Known wildlife travel routes that cross roads and trails could be identified with signs to reduce vehicle-wildlife encounters.

Workers involved in exploration and drilling operations should be made aware in advance of the sensitivity of wildlife areas (especially threatened and endangered species) and instructed not to harass or unnecessarily disturb wildlife while conducting their operations.

Reclamation plans for the site should consider present and future fish and wildlife values. Species favored by wildlife should be seeded to the maximum extent possible. Disturbed areas should be reclaimed to maximize habitat values while minimizing erosion. Reclamation should include replacement of rocks, snags, and other features. Reseeding should include forbs such as yellow sweet clover if the site is suitable. Easily established grass monoculture species such as crested wheatgrass should be avoided because of low wildlife values.

Special Measures for Grizzlies

Since the grizzly bear is one of the most sensitive species within the Overthrust Belt, the following special measures should be required.

Exploration activities should be restricted to a period when the least seasonal disturbance to grizzly bears and their habitats would occur; for example, this activity should be avoided on important spring ranges. Special stipulations should be required where bear travel routes, seasonal concentration sites, denning areas, and foraging habitat sites are involved.

Creeks, river bottoms, riparian and mesic habitats, and swampy areas important to the grizzly bear should be protected. These habitats are very sensitive and are essential to the future welfare and survival of the grizzly bear along the Rocky Mountain Front.

New exploration roads should be closed to other uses in occupied grizzly habitat. These roads should be reclaimed and physically closed to future motorized vehicle travel when oil and gas activities are completed.

Restrictions should be placed on the location of permanent and temporary camps associated with oil and gas activities on public lands within occupied grizzly habitat. Garbage should be hauled away each day.

Exploration and development activities should be excluded within 500 to 1,000 feet of perennial streams, depending on topography adjacent to the stream.

In areas where it is believed that an activity will affect the grizzly bear and its habitat, the activity should be closely monitored. The data collected should be analyzed to guide future management decisions on other areas within occupied habitat.

LAND USES

Recreation

Surface occupancy should not be allowed in any developed or undeveloped recreation site. Setbacks from all developed and undeveloped recreation sites should be required, or road use should be restricted during high recreation use periods.

Oil and gas activities should be required to comply with all vehicle use restrictions.

Wilderness

Activities on post-FLPMA leases within wilderness study areas require a wilderness protection stipulation. This stipulation requires that any activity permitted must be temporary and that its impacts must be capable of being reclaimed. It further requires that after reclamation the wilderness values of the WSA must not have been degraded to the point of significantly constraining the eventual recommendation of the Secretary of the Interior to Congress regarding the suitability of the area for wilderness classification.

Coordination with the Forest Service will be necessary before issuance of leases involving WSAs that are contiguous to Forest Service lands that have been designated wilderness or are under wilderness review.

Visual Resources

Design and planning for all activities and facilities should be done with consideration of benefits to long-term rehabilitation, as well as mitigation for short-term visual impacts. Design and planning criteria should include the following:

Use of flatter slopes rather than steep slopes for all facilities requiring earthmoving (road, drill pads, etc.).

Avoidance of timbered areas and use of such areas for screening.

Use of natural breaks in vegetation and/or topography for road and utility construction.

Joint use of access roads and strict limitations of vehicle use on other than established roads by operators during development and production phases.

Construction of slopes not steeper than 3:1 where this does not make long-term rehabilitation unreasonably costly.

Use of native plant materials for reclamation wherever it would not make rehabilitation unreasonably difficult or costly.

Use of rehabilitation techniques compatible with future use of the area.

Permanent and semipermanent structures should be painted with colors approximately the natural summer color of the landscape.

All facilities should be kept clear of unsightly debris. Refuse and all remnants of resource development, save a witness post where required, should be removed on or before the termination of the lease.

Except where construction is designed for permanent or future land use, the contour of the natural landscape should be restored or graded to a natural-appearing slope.

The district manager's approval of all plans and designs will be required. Information contained therein shall be mutually satisfactory to the district manager and the GS in terms of site conditions and prognosis for successful rehabilitation. The lessees will provide all required additional information at their own expense before the permit is processed, will modify plans and designs to the satisfaction of the district manager, and will provide adequate lead time for the processing of permits.

Cultural Resources

Oil and gas companies are committed to comply with legislation related to cultural resources both by a section that is standard on oil and gas lease agreements (Section 2-Q) and by a cultural resource stipulation (MSO 3100-47) that is attached to all oil and gas leases issued from the BLM's Montana State Office. This legislation includes the Antiquities Act of 1906, the National Historic Preservation Act of 1966, the National Environmental Protection Act of 1969, the Archaeological and Historic Preservation Act of 1974, and the Federal Land Policy and Management Act of 1976. This also entails a commitment to satisfy 36 CFR 1202 and 36 CFR 800, regulations to enforce the National Historic Preservation Act of 1966.

The Montana standard stipulation, MSO 3100-47 (see Appendix 3), requires the area of operation to be inventoried for prehistoric and historic features. The features inventoried should be described in a report, and appropriate mitigating measures should be applied. The stipulation further requires that operations be halted if previously undiscovered cultural remains are found as part of oil and gas operations, until appropriate action has been taken by the district engineer of the GS.

In areas where inventory has taken place and reporting has shown no surface indication of prehistoric or historic features, the applicant can proceed with operations, exercising caution to observe previously unreported cultural resources. Ground disturbance must be halted when any such materials are found.

Some areas have been completely or partially inventoried, and in these cases prehistoric or historic features are known to be within the area where lease activities are proposed. In these areas, further inventory probably would be necessary, or sites would need to be avoided, or a site might have to be excavated (after compliance with 36 CFR 800 was accomplished, if necessary) so that the data it contained could be recovered.

The disturbance of certain areas with known high cultural resource values cannot be mitigated except by avoidance or extensive excavation, which could take many months. If the operator is not able to avoid a sensitive site, measures must be taken to fully comply with 36 CFR 800 (see Appendix 5). Criteria for determining eligibility for the National Register of Historic Places must be applied. If the site is determined eligible by the keeper of the National Register, the State Historic Preservation Officer has been consulted, and the Advisory Council on Historic Preservation comments that the oil and gas operation has an adverse effect, the decision rests with the BLM district manager. The district manager can, upon the advice of the Advisory Council on Historic Preservation, require the applicant (operator) to avoid the area containing the site.

Mitigation could follow three paths in complying with 36 CFR 800: (1) if cultural resources were found to be present in the area of proposed operations, the applicant would be asked to move the operation to avoid the site; (2) if the site was found to be sensitive, and operations could not be moved, the site would be treated as explained above; and (3) if the operator did not move

the operation and damage to the site could be mitigated by recovery of data, the operator would be required to excavate or remove the components of the site.

THE SOCIOECONOMIC ENVIRONMENT

Economic and Social Conditions

Assuming development of one or more major oil or gas fields, the primary impacts would be in nearby communities, which would be called upon for services. Mitigation of these impacts would involve reducing the population influx by hiring local labor wherever possible and encouraging oil and gas companies to provide housing and other services for their workers.

Housing problems connected with exploratory operations could be eased by the companies cooperating more actively with local officials in providing housing or arranging transportation to the nearest town with adequate housing. Companies could work with county officials to minimize road problems, emphasizing prevention of poor road conditions through maintenance and rehabilitating roads after operations cease. Any new semipermanent roads should be planned with local officials before operations begin.

If a major field was not developed in the area, the impact of oil and gas leasing on the general social and economic conditions of the area would be minimal.

THE ROCKY MOUNTAIN FRONT

All the mitigating measures described in this section apply to the Rocky Mountain Front area. In addition, interagency coordination and monitoring of impacts will be emphasized for the Rocky Mountain Front.

The Lewis and Clark National Forest and the Butte District of the BLM signed a coordination agreement for land management in 1980. The agreement specifically mentions a joint effort to determine where to lease and under what stipulations. It also requires joint meetings on current and planned activities to estimate cumulative effects on resources impacted by oil and gas activities. These meetings have involved the MDFWP and the USFWS as well as the Forest Service and the BLM.

A program that the four agencies have approved outlines a ten-year monitoring plan for key wildlife species in the area. The program involves gathering baseline data and monitoring the effect of development activities on wildlife. The results will be used to develop management guidelines for directing activities such as oil and gas leasing and development in the Rocky Mountain Front area.

RESIDUAL ADVERSE IMPACTS

This section discusses the adverse impacts that would remain after application of the mitigating measures discussed in the preceding section.

THE PHYSICAL ENVIRONMENT

Geology

Minor impacts to paleontological features could result from the full range of surface-disturbing actions associated with oil and gas activities.

Soils

Even under the most careful management, some soil areas could be difficult to reclaim, especially if pipelines, pads, or other construction structures were placed on sensitive and critically sensitive soils.

Oil and gas activities could have residual adverse impacts on soils with slopes of more than 15%. These impacts might not be mitigated where steeper slopes were combined with highly erosive soils in sensitive or critically sensitive categories.

Removal of buildings, storage tanks, and other facilities during abandonment could result in impacts as great as those that occured during the initial installation. Fill material would replace soil that was surplus during construction. Impacts from the removal of soil fill could occur at the location where the new fill material was obtained.

An accident leading to an oil spill could cause significant and irretrievable loss of soil productivity for several years. However, with time and careful rehabilitative efforts, soil productivity might be reestablished. Some loss of soil productivity could occur as a result of construction.

It is likely that some erosion would continue on disturbed sites. Rehabilitated areas and resultant soil profiles would not conform to original soil series characteristics, and natural soils in that area would be lost.

Water

Any surface disturbance would result in increased erosion and sediment yield. It is reasonable, however, to expect that erosion and sediment yield would be reduced substantially with vigorous enforcement of the mitigating measures. Erosion and sediment yield would continue above normal until disturbed areas had been rehabilitated to their approximate original contours and percentage of ground cover.

THE BIOLOGICAL ENVIRONMENT

Vegetation, Range, and Forestry

Residual impacts after exploration would be relatively minor. Most vegetation damaged during exploration would recover after the exploration ceased. The actual sites of wells and associated structures would, of course, be devoid of vegetation during the entire development phase. There would be no residual impacts to vegetation after abandonment if the mitigating measures were applied properly.

Fish and Wildlife

Exploration resulting in the discovery of oil and the subsequent development of a production area would present the greatest potential for residual impacts to fish and wildlife. The discovery of natural gas and the development of gas production areas would have a lesser impact because the transportation system for natural gas would be underground; however, both types of production areas could result in residual impacts to fish and wildlife.

Increased road and trail development, particularly along the Rocky Mountain Front, would cause impacts for which complete mitigation would be difficult. Road and trail development increase human activity in an area, and that would be detrimental to the grizzly bear in particular. Under the exploration phase of oil and gas development, increased human activity would be the major impact on wildlife.

System failures such as oil spills, leaks, and reserve pit failure provide the greatest potential for impacts to the water resource. Present safety regulations and stipulations greatly reduce the number and severity of such accidents.

LAND USES

Recreation

Road construction would cause the most lasting impact to recreation. Increased access over a 20 to 30 year production period could change recreational use patterns. This could include more intensive uses such as road hunting, general ORV use, and snowmobiling. Some forms of recreation could benefit from increased access.

Wilderness

The apparent naturalness of a WSA would be maintained if all nonimpairment criteria were met.

Visual Resources

Generally, no adverse impacts would be likely to remain after the abandonment phase if mitigative measures were applied. Furthermore, the impacts occurring during each phase could be reduced to acceptable levels; that is, the contrast of the activity with the landscape could be maintained within the visual resource management quality objectives.

Cultural Resources

The major residual adverse impacts would occur when oil and gas operations were carried out in areas with known cultural resource values. Those sites have potential importance for visitors, and the impacts would be difficult to mitigate by data recovery. Damage or destruction of these sites would be a major impact that could not be mitigated.

Where features and sites were not avoided, and the sites were excavated, beneficial information could be gained. However, the excavated sites would not be available for later study, when improved archaeological methods might be developed; thus, a partial residual adverse effect would occur.

THE SOCIOECONOMIC ENVIRONMENT

Economic and Social Conditions

In a major development situation, not all of the population influx could be mitigated. Strain would be placed upon community services, but at this time the actual impact cannot be measured. It would depend greatly on the affected community and the size of the development.

Economic problems could result when production declined in a major field. Both economic and social impacts would be greater if development took place near small towns such as Augusta or Wisdom than if it occurred near Helena or Butte.

CHAPTER 3

ALTERNATIVE TO THE PROPOSED ACTION

THE "NO ACTION" ALTERNATIVE

This chapter addresses the potential impacts on the region and the nation that would result from the "no action" alternative. The structure of the BLM's oil and gas leasing program allows the discontinuation of leasing for appropriate reasons but does not provide for the setting of arbitrary production/leasing levels of federally administered oil and gas resources. Accelerated or decelerated leasing levels are not analyzed, but they would result in graduated levels of impacts in comparison to those discussed.

The "no action" alternative assumes that the Secretary of the Interior would exercise his authority to discontinue leasing of federal oil and gas in the Butte District. The effect of this alternative on regional and national supplies of fossil fuels and on the physical and human environment is addressed. It should be noted that although implementation of this alternative is unlikely, oil and gas leasing by the BLM is discretionary; therefore, it could be halted altogether if adequate justification existed.

The discontinuation of the BLM's Montana oil and gas leasing program would result in the curtailment of future production of federal oil and gas resources. Immediate impacts would be (1) a loss of these two fossil fuel sources to the state and the nation, (2) direct loss of employment and income for oil and gas workers associated with the exploration, development, and production of federal oil and gas resources, (3) loss of economic production due to elimination of this energy source, (4) indirect (secondary) losses in employment and income, (5) loss of federal oil and gas bonuses, rents, royalties, and filing fees, and (6) elimination of future surface disturbance from leasing on lands overlying federal oil and gas resources.

Discontinuation of federal leasing probably would also cause intensification of oil and gas exploration and development on existing blocked-up federal leases and on adjacent lands where the state government or private interests own the subsurface rights. Such exploration and development probably would bring about impacts similar to those expected under the proposed action.

In areas without blocked-up leases, the "no action" alternative would probably result in a lower rate of exploration and development because the industry would be unable to build large lease blocks before making large investments in exploration and development. However, if discoveries were made on private or state lands adjacent to unleased federal reserves, the discoverers could drain federal reserves without paying federal royalties.

IMPACTS OF THE ALTERNATIVE

GEOLOGY

The impact of this alternative on the geology could be a greater dependence on coal to make up the energy resource loss.

SOILS

Impacts to soils on existing, unexpired lease holdings would be identical to those described in Chapter 2. It is likely that increased activity on unexpired federal leases could lead to greater soil-related impacts than are now occurring. Impacts from geophysical operations would continue.

WATER

This alternative could initially have an increased adverse impact on the water resource. Exploration activities would increase on existing leases as attempts were made to discover oil and gas before the leases expired. The impacts associated with preliminary exploration, exploratory drilling, and development, which were discussed in Chapter 2, probably would increase substantially or at least become more concentrated before leases expired.

Over a period of eight to ten years, exploration activity on existing federal lease holdings would decline. Eventually, after all existing leases expired, there would be no new impacts from exploration or development on lands over federal oil and gas subsurface. Impacts from production would continue until existing oil and gas fields were abandoned. Hydrologic impacts from geophysical activity would continue in the absence of federal leasing.

VEGETATION, RANGE, AND FORESTRY

With this alternative, drilling would continue for an unknown period on existing producing leases—perhaps for 20 years or more. Vegetation impacts would be likely to increase on surface underlain by private minerals. Impacts from geophysical exploration would continue even in the absence of federal leasing. If leasing did not occur, there would be no effects on the livestock using lands overlying federal oil and gas estates.

FISH AND WILDLIFE

Discontinuing federal oil and gas leasing would create impacts on wildlife comparable to those discussed in Chapter 2, but on a smaller scale. Existing leases would be developed more rapidly, and the impacts would continue until abandonment or expiration. However, the impacts of oil and gas leasing would continue if mineral leasing and development occurred (possibly at an accelerated pace) on private and state surface. Many species of wildlife are mobile creatures; consequently, a private oil and gas production area adjacent to public lands would affect those species in the general area.

RECREATION

If federal leasing did not occur, there would be no direct impacts on recreation on BLM land beyond those associated with normal population growth. Continued activity on state and private lands could cause increased recreational use on BLM land.

WILDERNESS

This alternative would have a beneficial impact on wilderness values because it would remove the potential for disturbing the solitude and naturalness of BLM lands.

VISUAL RESOURCES

The no action alternative could have direct significant adverse impacts on Class A and Class B public lands because of increased and rapid oil and gas activity on existing leases. It also could have indirect adverse impacts on public lands because of increased and rapid activity on private and state mineral rights lands, if those lands were adjacent to public lands of high or

moderate scenic values or interspersed with such public lands. These could be long-term impacts. This alternative probably would have little or no adverse impact on Class C public lands. If the increased oil and gas activities discussed above did not transpire, then the no action alternative would be advantageous to the area's visual resources.

CULTURAL RESOURCES

The only impacts to cultural features that would be expected in the absence of federal leasing are those identified in Chapter 2 concerning geophysical exploration. These would occur since geophysical operations would continue even in the absence of federal leasing.

ECONOMIC AND SOCIAL CONDITIONS

Discontinued leasing of federally owned oil and gas in the Butte District would result in a partial loss of the oil and natural gas produced annually.

There is a great deal of geophysical exploration in the district now, and a number of drilling projects and proposals are underway. No employment figures are available. For the purposes of this report, it is assumed 80 to 100 people in the district are employed by the oil and gas industry. The effect of no leasing on this figure is impossible to predict because of the large amount of state and private mineral estate available for exploration and development.

CHAPTER 4 THE AFFECTED ENVIRONMENT

INTRODUCTION

This section describes by environmental component the physical, biological, and cultural features of the study area. Particular emphasis is placed on describing features on which impacts from oil and gas activity can be expected. Physical and biological features in the district are varied; for this reason, no attempt is made to describe them in detail.

This section is merely a summary; it is supplemented by additional information available in resource area field offices and the district office. This information is used in the processing of lease applications. Also see the Land Status map.

THE PHYSICAL ENVIRONMENT

GEOLOGY

The Butte District is located generally within the Overthrust Belt, a complex regional thrust system characterized by shallow west-dipping faults upon which older rocks moved eastward. A great many types of igneous, metamorphic, and sedimentary rocks are present in the district. Detailed geologic maps and publications are available in the district and field offices.

Significant paleontological finds have been made in Mesozoic rocks in the area west of Choteau in recent years. Information as to exact locations is not available.

SOILS

Soils in the Butte District are diversified, having been formed from deposits ranging from basalt, limestone, sandstone, and conglomerates to mudstone, argillites, quartzites, granite, and glacial till. Consequently, the range of chemical and physical characteristics is wide and varied.

Five major soil orders are represented in the Butte District. These include Mollisols, Alfisols, Aridisols, Entisols, and Inceptisols.

Mollisols have a dark surface horizon, are generally under herbaceous vegetation, and have a dominance of bases in the profile. Mollisols in the district can be shallow, clayey, wet, cold, and/or carbonatic.

Alfisols have a gray, brownish, or reddish surface horizon, are under coniferous vegetation, have a medium to high supply of bases, and are clayey. Alfisols in the district can be cold or wet, or both.

Aridisols lack water most of the time for plant growth and have a light-colored surface horizon. Aridisols occur under herbaceous vegetation and may be clayey or carbonatic or may have simple horizonation without clays or carbonates.

Entisols are young soils without distinct pedogenic horizons. They occur under herbaceous and coniferous vegetation. They may be hot and dry, wet, shallow, or cold.

Inceptisols are young soils with some distinct horizonation. They occur under herbaceous and coniferous vegetation. Inceptisols in the district may have amorphous clay and can be wet or cold, or both.

Detailed soil survey maps that are available for many parts of the district are used for site-specific review of lease applications.

WATER

The area lies in two large river basins, the Clark Fork and the Missouri River.

Clark Fork

The Upper Clark Fork basin contains five major sub-basins. These are the Clark Fork River above Milltown, Blackfoot River, Clearwater River, Flint Creek, and Rock Creek. The Geological Survey has had 18 streamflow gaging stations in the Upper Clark Fork basin; 13 of these remain active. Geological Survey data for gaging stations in the study basin are in "Water Resources Data for Montana," GS Water Data Report MT-77-1.

Streamflows in the Upper Clark Fork basin are affected by weather conditions, geology, and irrigation. A major part of the annual flow occurs during the spring runoff. However, spring runoff is a function of weather and precipitation and is variable in time and volume. March through July is the most common snowmelt period, but warm weather in midwinter can produce significant short-term increases in streamflows. Peak flows from mountain streams such as Rock Creek tend to occur from mid-May through early July.

Missouri River

The Upper Missouri tributaries basin contains eight major sub-basins. They are the Red Rock, Beaverhead, Big Hole, Ruby, Madison, Jefferson, Boulder, and Gallatin river drainages. The Geological Survey has had 86 streamflow gaging stations in the Upper Missouri tributaries basin; 14 of these remain active.

Streamflows in the Upper Missouri tributaries basin are affected by local weather conditions, geology, reservoirs, and irrigation. A major part of the flow occurs during spring runoff. However, spring runoff is a function of weather and precipitation and may be quite variable in both time and volume. March through early July is the most common snowmelt period, but warm weather in midwinter can produce significant short-term increases in streamflows. Peak flows from mountain streams tend to occur from mid-May through early July, whereas foothill streams may reach peak streamflows in March.

The Missouri-Sun-Smith basin contains six major sub-basins. These are the Missouri River above Holter Dam, Smith River, Missouri River from Holter Dam to Sun River, Dearborn, Sun River, and the Missouri River from Sun River to Marias River. The Geological Survey has had 62 streamflow gaging stations in the Missouri-Sun-Smith basin; 12 of these remain active.

The Marias basin contains four major sub-basins. These are Cut Bank Creek, Two Medicine Creek, Teton River, and the main stem of the Marias River with smaller tributaries.

The Geological Survey has maintained 52 streamflow gaging stations in the Marias drainage basin. Only 24 of these have a period of record of ten years or longer; of the 24, 11 are currently active. Streamflow data have been recorded for the Marias River at four locations and at other stations on its main tributaries, the Teton River, Dry Fork of the Marias River, Cut Bank Creek, Two Medicine Creek, and Birch Creek. The total flow from the basin in water year 1971 exceeded 930,000 acre-feet. The largest tributary, Two Medicine Creek, provided 302,000 acre-feet, or about 34 percent of the total flow. Sensitive and critically sensitive hydrologic features are shown on Hydrologic Sensitivity map.

THE BIOLOGICAL ENVIRONMENT

VEGETATION, RANGE, AND FORESTRY

Surface ownership of the rangeland in the Butte District is a mixture of federal, state, and private. However, the mineral rights of much of the state and private land have been reserved to the United States. These rangelands run the gamut from nearly pure grassland at low elevation to forest-range types at higher elevations near the national forest boundaries.

Permits for grazing on BLM-managed public lands are held by 734 livestock operators in the district. Some of these operators also graze their livestock on private and state land with federal minerals.

Coniferous forests in much of the district's mountainous terrain amount to approximately 355,000 acres. Major species are lodgepole pine, Douglas-fir, ponderosa pine, western larch, Engelmann spruce, and subalpine fir. Sites range from wet, marshy spruce sites to high alpine types. Most of the timber is found on north and east slopes, with more scattered forest on dry south and west slopes.

Areas identified as commercial forestland can sustain an annual cut of approximately 12 million board feet.

FISH AND WILDLIFE

Resident wildlife species in the area are primarily the responsibility of the Montana Department of Fish, Wildlife, and Parks. Protection of endangered and threatened plant and animal species is the responsibility of the U.S. Fish and Wildlife Service. Habitat on public lands for all these species is managed by the Bureau of Land Management; thus, interagency coordination in assessing impacts and developing effective mitigating measures is required. Furthermore, complicated land patterns (federal surface and subsurface or private surface and federal subsurface) require close communication between all agencies and the private landowners.

The Butte District supports outstanding big game populations and provides yearlong habitat for elk, mule deer, white-tailed deer, mountain goat, bighorn sheep, moose, and black bear. Grizzly bear and northern Rocky Mountain wolf also inhabit the area, especially the east slope of the Rocky Mountain Front. The Butte District supports a wide variety of bird life, including upland game birds, waterfowl, raptors, and songbirds.

General distribution maps provided in this analysis show the distribution of primary wildlife species within the Butte District. Detailed inventory information is available from BLM wildlife habitat inventory documents, from MDFWP progress and completion reports, and from published research and pending studies and inventories (e.g., East Slope Rocky Mountain Front Mule Deer Study inventories).

The habitats for the district's wildlife consist of a diversity of vegetation types: alpine, subalpine, forested, mesic bottomland, prairie, and cold desert areas.

High quality fisheries within the Butte District include the Yellowstone, Big Hole, Madison, and Blackfoot rivers (see the Fisheries map).

Because the wide variety of big game species in the area has different habitat requirements, each important species is described below. Periods of known sensitivity to disturbance are identified in Figure 4-1.

Elk

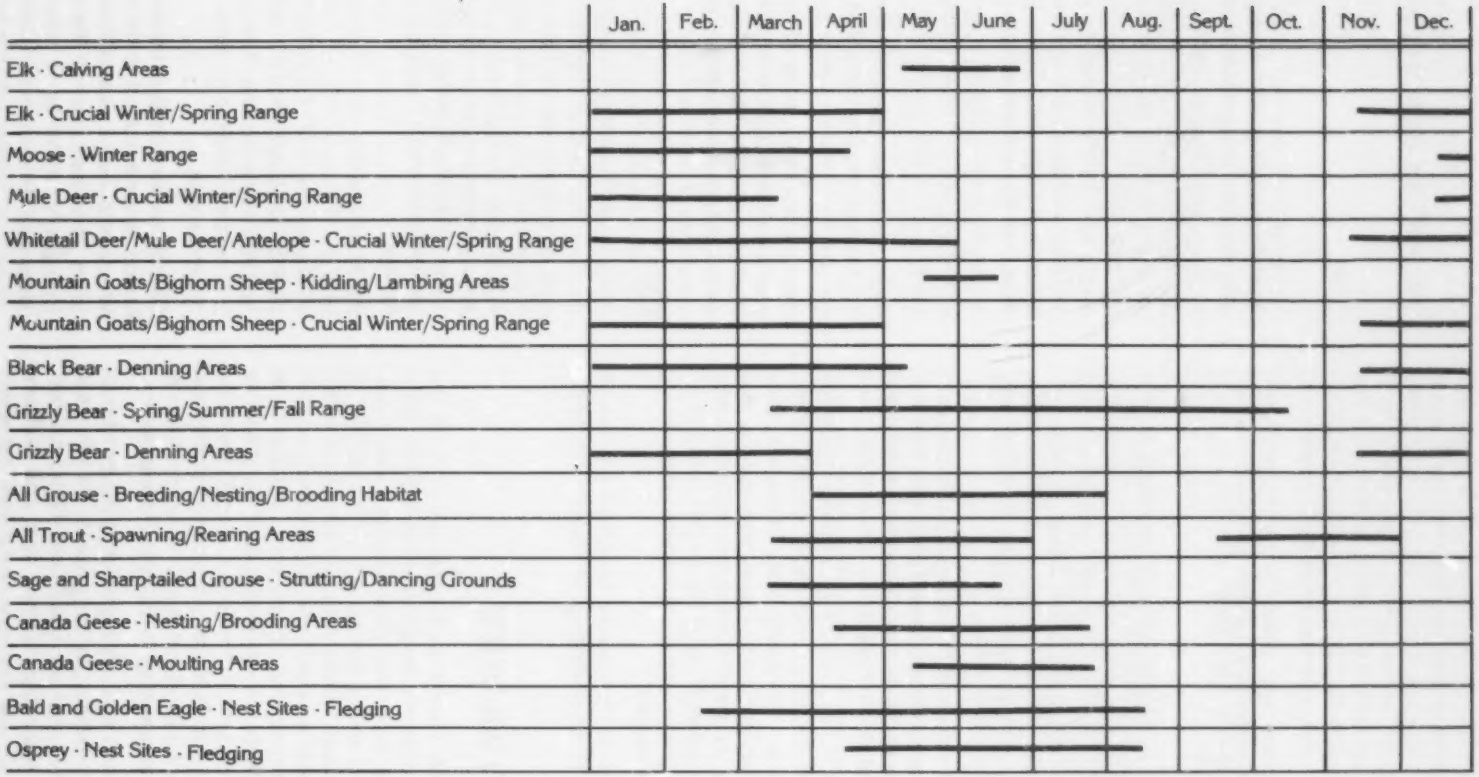
Elk are widely distributed throughout western Montana (see the Moose and Elk map). Distribution of elk is closely related to the location of forested areas. Land uses affecting elk management include livestock grazing, timber management, expansion for subdivision and recreation resorts, and increased human activity on various habitats. More recently, oil and gas exploration has become a significant factor affecting elk and elk habitat.

Elk are one of the most important wildlife resources in western Montana. Since 1971, elk hunting has increased at a rate of approximately 7% per year. The MDFWP predicted 800,000 elk hunting recreation days for 1980 within the state. A large percentage of this use is in western Montana on areas with federal subsurface mineral estate.

Elk migrate seasonally to lower elevations where winter-spring range is critical to the survival of the species. Windswept south exposure bunchgrass ranges at these lower elevations provide the bulk of winter forage. Douglas-fir habitat types adjacent to winter foraging areas provide security and thermal cover. Elk summer range is associated with the spruce, subalpine fir, and

FIGURE 4-1

Sensitive Periods of Disturbance for Montana Wildlife Species



——— indicates most sensitive period.

whitebark pine habitat types, and to a lesser degree with the lodgepole and Douglas-fir habitat types. Summer range is more extensive than winter range. Calving habitat is usually in Douglas-fir/sagebrush/grassland edges.

Studies dealing with elk in this area include Rouse (1957), Reichelt (1973), Eustace, (1967), and Knight (1970).

Mule Deer

Mule deer are widely distributed throughout the Butte District; they occupy practically all elevations from 5,000 feet on sagebrush bottomlands to 9,000 feet in subalpine habitat types. In general, mule deer prefer rather open country with good interspersion of forage supplies and escape cover. Mid-elevational areas provide important winter-spring range for mule deer in the study area.

During periods of severe weather and snow cover conditions, mule deer migrate to lower elevations to seek winter browse. This consists of big sagebrush, curlleaf mountain mahogany, Douglas' rabbitbrush, and bitterbrush.

Studies dealing with mule deer in this area include South (1957) and Duncan (1975). Population densities vary seasonally on public lands, with the greatest densities found on winter-spring foothill browse ranges. Public lands are generally at lower elevations adjacent to national forest lands. They provide a large percentage of the winter-spring range for mule deer within the Butte District. The general distribution of mule deer in western Montana is shown on the Deer map.

Bighorn Sheep

The largest bighorn sheep population in the continental United States is found in the Butte District, in Teton County. A herd of nearly 1,000 animals exists along the Continental Divide from the Sun River north to the Teton River (see the Pronghorn Antelope and Bighorn Sheep map). The habitat of this species is almost entirely underlain with federal subsurface mineral estate. Bighorn sheep must be considered one of the primary big game species subject to disturbance by oil and gas exploration and development.

Another bighorn sheep population affected by oil- and gas-related activities on public lands is the Soap Creek/Camp Creek population south of Butte.

Rocky Mountain Goat

Rocky Mountain goats are found in rugged, rocky habitat in mountain ranges in the Butte District (see the Rocky Mountain Goat and Black Bear map). Cliffs, steep rocky slopes, rockslides, and glaciated basins are typical goat habitat in this area. The vegetation of such areas is typically alpine or subalpine. Forbs are most important as forage in summer, then the animals shift to grass and grasslike plants such as sedges or rushes after the forbs dry up. In some areas shrubs are very important during the spring, summer, and winter.

Grizzly Bear

Section 7 of the Endangered Species Act (1973) requires federal agencies to (a) ensure that the continued existence of listed species is not jeopardized, and (b) ensure that critical habitats of listed species are not destroyed or adversely modified. The grizzly bear was officially listed as a threatened species by the Secretary of the Interior in September 1975.

Grizzly range in Montana has been divided into two general areas, the Bob Marshall ecosystem and the Yellowstone ecosystem (see the Grizzly Bear map). Research and management efforts are underway in both of these areas so that potential habitat, intermittently occupied habitat, occupied habitat, and critical habitat can be determined (Jonkel 1976).

There currently are more than 19,200 acres of BLM-managed surface and more than 103,000 acres of federal subsurface minerals in the Rocky Mountain Front region. Included in this region are lands that the BLM considers essential for the recovery of the threatened grizzly bear in the Bob Marshall ecosystem. Also included are lands that the U.S. Fish and Wildlife Service has proposed for designation as critical grizzly bear habitat. The proposed classification led to the initiation of the Border Grizzly Research Project for the Rocky Mountain Front area. The study, funded by the BLM, began in 1977 and was completed in 1980. Cooperative monitoring of bears in key areas is carried out by the Montana Department of Fish, Wildlife, and Parks, the U.S. Fish and Wildlife Service, the Forest Service, and the BLM.

Black Bear

Black bear are widely distributed in most timber/coniferous forest areas of the district (see the Rocky Mountain Goat and Black Bear map). Black bears eat a variety of grasses, forbs, sedges, fruits, small mammals, pine nuts, berries, and carrion when it is available. If garbage dumps are located within their home range, they are commonly seen there. Black bear habitat is best when not altered by clearcutting practices, agriculture, or subdivision activity.

Northern Rocky Mountain Wolf

The U.S. Fish and Wildlife Service added the northern Rocky Mountain wolf to the list of endangered species on June 5, 1973.

Small populations of wolves have been verified for western Montana, portions of Idaho, and northwestern Wyoming (Day 1978; Mattson and Ream 1978; U.S. Dept. of the Interior, Nat. Park Svc. 1975, 1978). Two gray wolves were sighted near Wigwam Creek in the Gravelly Mountain Range southwest of Ennis on June 20, 1975. Wolves also were seen in 1972 on the Wall Creek Game Range near Ennis. Other signs of wolves in the Green Horn area near Ruby Reservoir were reported in 1974 and 1979.

There have been 78 reports of wolves in the Rocky Mountain Front area. Of these, 42 reports were rated very good, 30 good, and 6 fair. Thirty-eight reports were of wolf sightings, 39 were of wolf signs, and 1 was a verified report of a dead wolf. Essential habitat and proposed essential habitat for wolves in this area is shown on the Northern Rocky Mountain Wolf map.

Recent studies and investigations of wolves in Montana indicate that wolves travel great distances on a year-round basis. Their movements may be influenced by the availability of prey species such as deer, elk, bighorn sheep, or livestock. Sightings, which are infrequent and widely scattered, suggest a transient population rather than a resident one.

Mountain (Forest) Grouse

Three species of mountain (forest) grouse are found in the district: blue grouse, ruffed grouse, and Franklin's (spruce) grouse. All these species are common to the coniferous forests of western Montana and isolated mountain ranges. They usually are associated with Douglas-fir mountain ranges throughout the district (see the Ruffed Grouse and Spruce Grouse map). Spruce grouse are found at higher elevations in denser forest types such as alpine fir and Engelmann spruce. Forest grouse are dependent on forest types and on the status of growth stages of these types, which in turn are affected by human-caused activities such as logging, grazing, and fires.

Sage Grouse

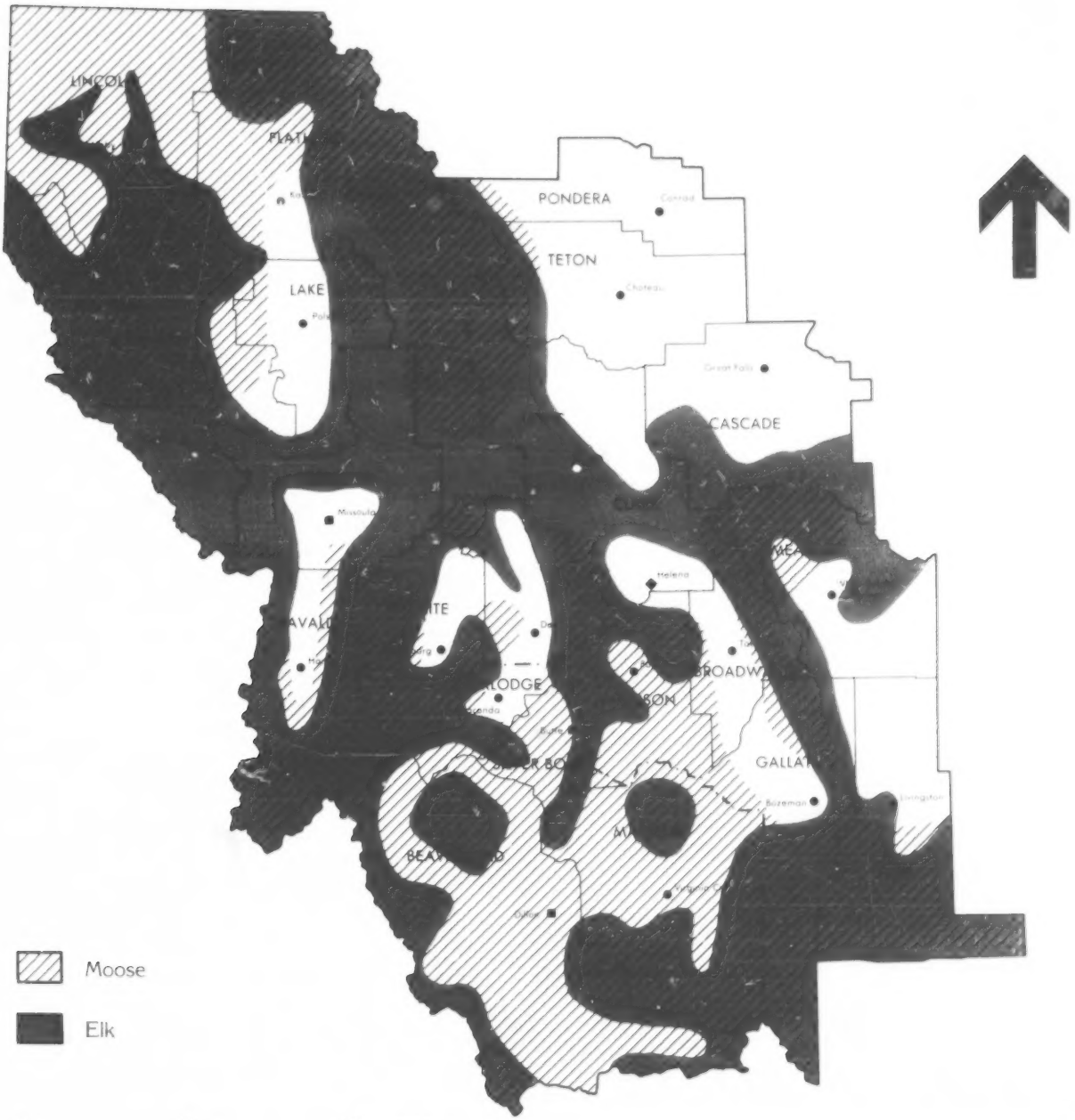
Sage Grouse generally are found associated with sagebrush vegetation types. Their populations in western Montana are somewhat isolated because suitable sagebrush habitat is scattered. They depend on sagebrush for food, especially in winter, and for cover and resting areas in all seasons. Sagebrush cover in the vicinity of strutting grounds is particularly important.

Sharp-tailed Grouse

Sharp-tailed grouse, like sage grouse, generally are found in scattered, isolated populations in the Butte District. Their habitat is primarily upland-grassland prairie adjacent to agricultural bottomlands. Sharp-tailed grouse prefer areas with good and excellent grass cover interspersed with deciduous woody vegetation. Residual grass cover is particularly important in wintering areas and in spring nesting and brood-rearing areas.

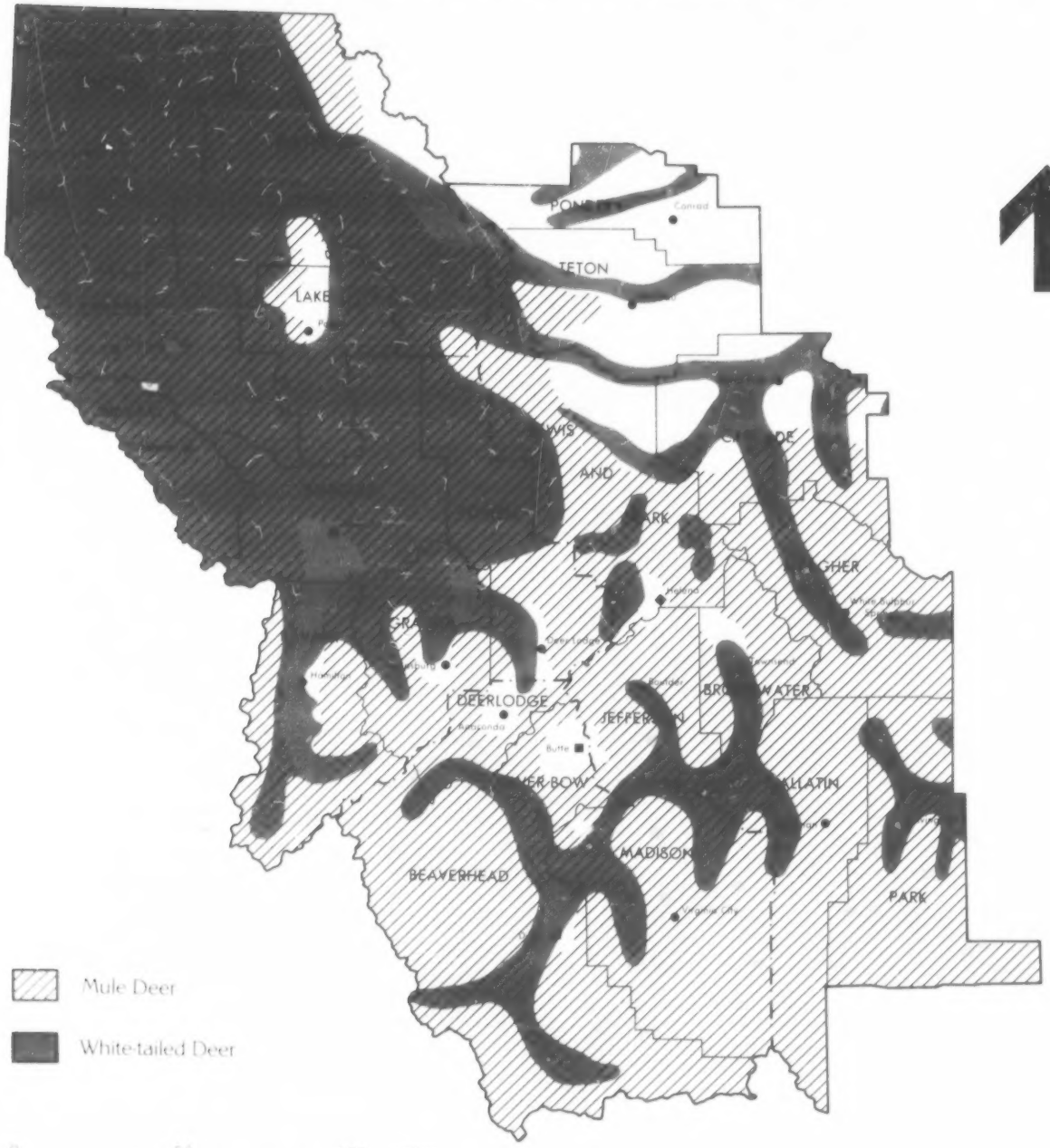
The distribution of these two species is shown on the Sage Grouse and Sharp-tailed Grouse map.

MOOSE AND ELK, GENERAL DISTRIBUTION



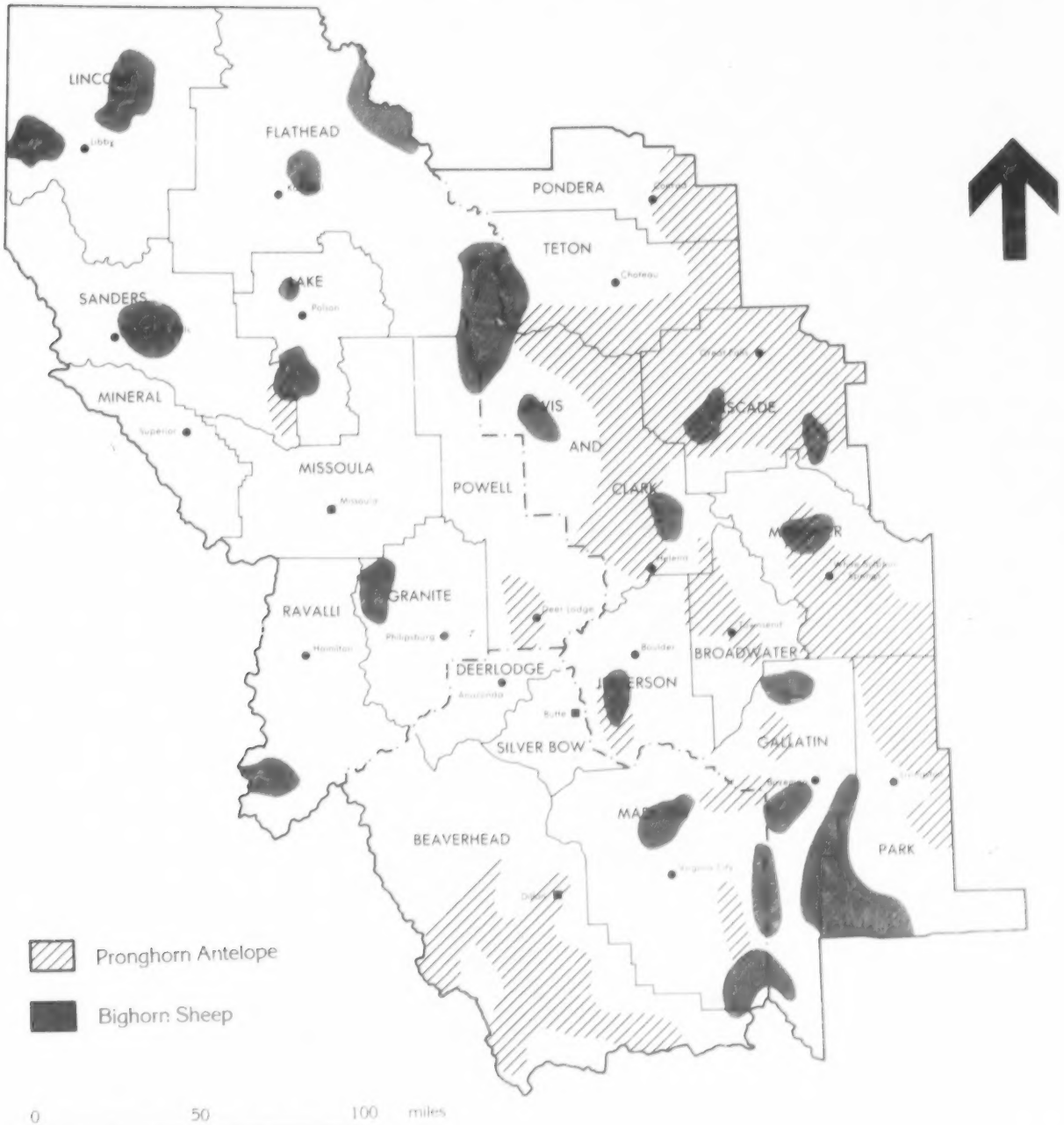
source Adapted from Montana Department of Fish, Wildlife and Parks, *Game Management in Montana 1971*

MULE DEER AND WHITE-TAILED DEER, GENERAL DISTRIBUTION



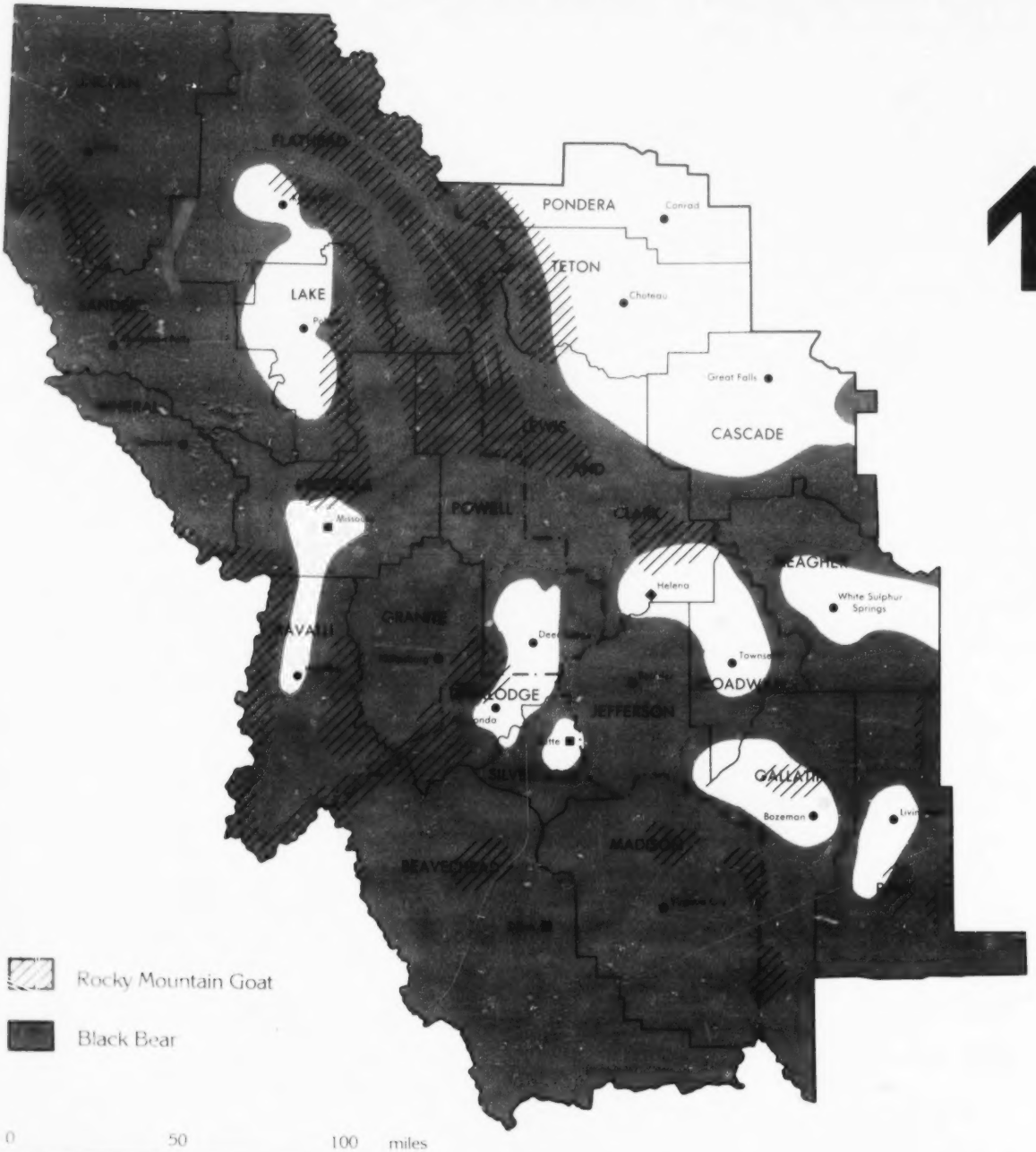
source: Adapted from Montana Department of Fish, Wildlife and Parks, *Game Management in Montana 1971*

PRONGHORN ANTELOPE AND BIGHORN SHEEP, GENERAL DISTRIBUTION



source Adapted from Montana Department of Fish, Wildlife and Parks, *Game Management in Montana 1971*

ROCKY MOUNTAIN GOAT AND BLACK BEAR, GENERAL DISTRIBUTION



source Adapted from Montana Department of Fish, Wildlife and Parks, *Game Management in Montana 1971*.

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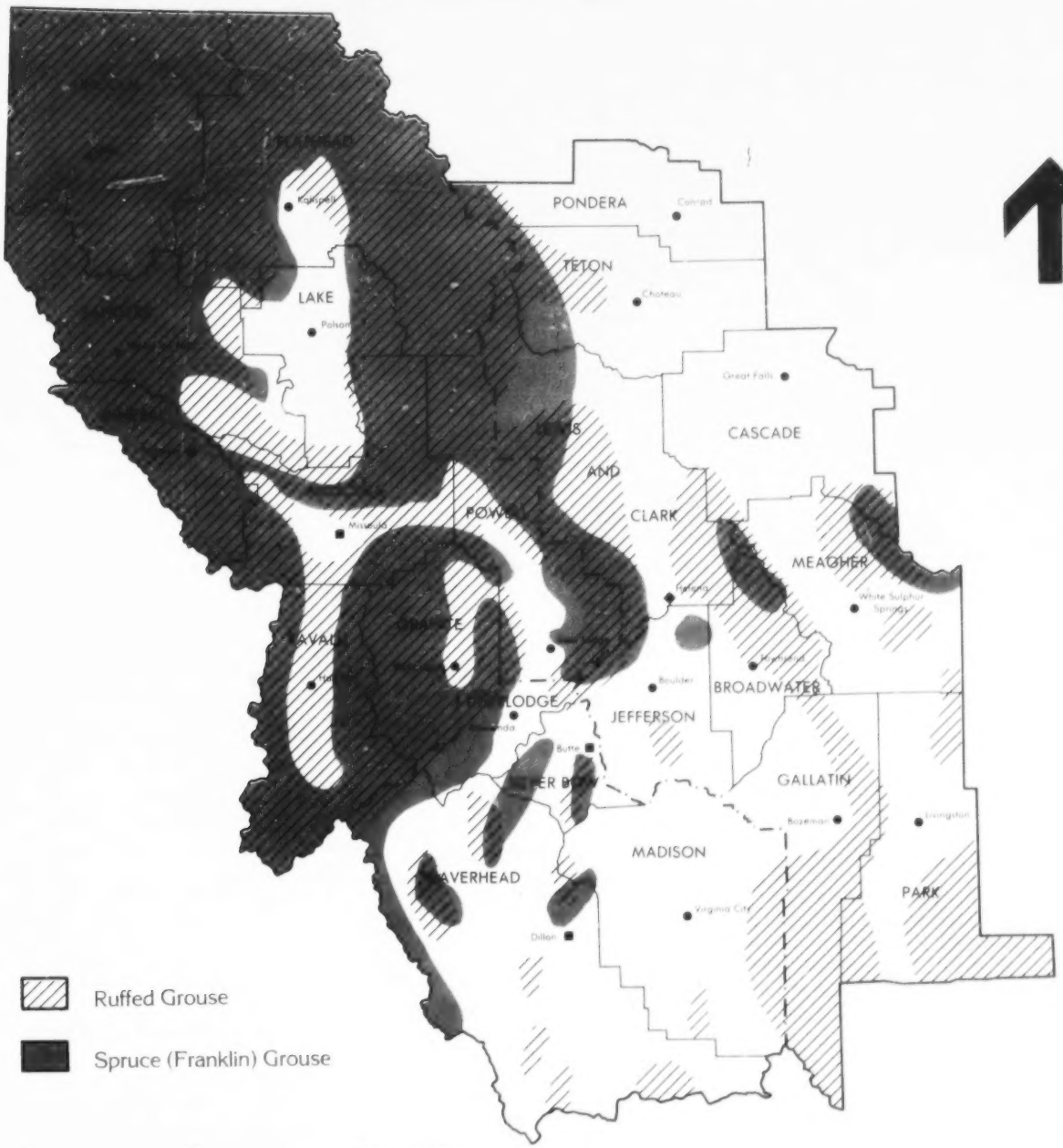
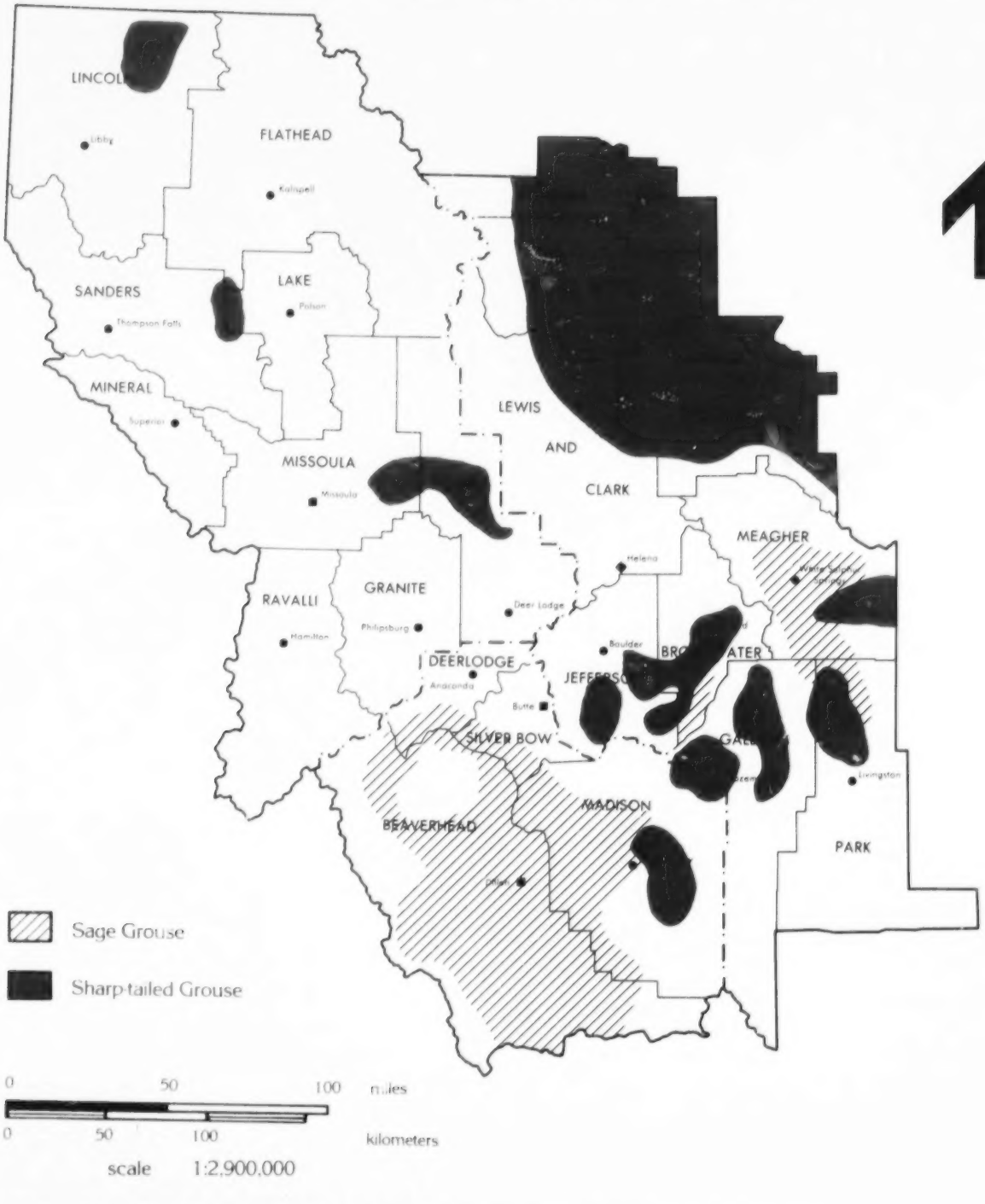
RUFFED GROUSE AND SPRUCE (FRANKLIN) GROUSE, GENERAL DISTRIBUTION



source Adapted from Montana Department of Fish, Wildlife and Parks, *Game Management in Montana 1971*

SAGE GROUSE AND SHARP-TAILED GROUSE, GENERAL DISTRIBUTION



source Adapted from Montana Department of Fish, Wildlife and Parks, *Game Management in Montana 1971*

LAND USES

RECREATION

Recreation on BLM land is primarily dispersed. Travel zones identified on the Recreation map provide important opportunities for vehicle-based recreation, including sightseeing.

It is predicted that recreational use of public lands will increase dramatically in the next 20 years as a result of population growth and nationwide increases in available leisure time. This may or may not be offset somewhat by the cost of energy. The public lands in the Butte District, which are primarily undeveloped and semi-developed, are an important part of the regional recreation spectrum. A reduction in the availability of recreational opportunities in the Butte District could affect the balance of opportunities available to the recreating public. The elimination of a suitable land base would effectively eliminate the ability of people to participate in area-specific activities and in those for which there is no substitute.

Undeveloped and primitive campgrounds are not generally identified or signed except by the presence of fire rings or other evidence of use such as garbage or trampling. The location of these campsites is primarily determined by the surrounding scenic quality and the presence of water.

Most developed campgrounds, which generally are located along rivers, lakes, or highways, have been landscaped to improve scenic quality and enhance the visitor's experience. Some BLM-managed campgrounds are Holter Lake, South Madison, West Madison, Red Mountain, and Carbella.

Off-road vehicle restrictions have been established in some areas to benefit wildlife, soils, and watershed and to enhance the hunting experience. These are primarily in the Missoula area; however, the entire Dillon Resource Area is in the process of designating areas either open, limited, or closed to ORV travel (see the Recreation map).

Most designations are seasonal closures, and in some cases they are restricted to specific vehicles. Most seasonal closures are during the winter so that crucial wildlife habitat can be protected.

Popular activities in the district are hunting, fishing, floating, backpacking, horseback riding, rockhounding, camping, sightseeing, historic and cultural enjoyment, cross-country skiing, snowshoeing, and snowmobiling. Use levels vary according to area and season. Some floating is done on most rivers in the district. The Smith, Blackfoot, Madison, Big Hole, Beaverhead, Clark Fork, Dearborn, Yellowstone, Gallatin, Jefferson, and Missouri are the most popular and receive considerable use.

WILDERNESS

The Federal Land Policy and Management Act of 1976 (FLPMA) requires the Secretary of the Interior and the BLM to review areas of the public lands determined to have wilderness characteristics (Wilderness Study Areas, or WSAs), and to make appropriate recommendations to the President as to the suitability or nonsuitability of each such area for preservation as wilderness. The Secretary is required to report his recommendations to the President by October 21, 1991, and the President is required to report his recommendations to Congress by October 23, 1993.

During the period of this review and until Congress acts on the President's recommendations, the Secretary and the BLM are required to manage such lands so as not to impair their suitability for preservation as wilderness, subject to certain exceptions and conditions outlined in FLPMA and further described in the BLM's *Interim Management Policy and Guidelines for Lands Under Wilderness Review*.

Likewise, FLPMA requires the Secretary of the Interior and the BLM to manage in a similar manner all natural areas and primitive areas formally identified before November 1, 1975. These areas, which are called Instant Study Areas (ISAs), also will be reviewed, and appropriate recommendations will be made to the President and to Congress as to their suitability or nonsuitability for preservation as wilderness.

The Butte District is in the last stage of the six-step process used to identify WSAs. Fourteen areas comprising 51,711 acres have been formally identified as WSAs to date. Eight additional areas totaling 92,833 acres identified as WSAs are under appeal. Further, five areas comprising 30,592 acres that were found unqualified for identification as WSAs have been appealed; they are still subject to the BLM's interim management policy and guidelines.

There are three ISAs in the Butte District. These are the Humbug Spires, Bear Trap Canyon, and Centennial Mountains. Recommendations for these areas, which total 61,316 acres, are being developed. Butte District WSAs and ISAs are shown on the Recreation map.

VISUAL RESOURCES

Landscape Character

So that the relative inherent scenic quality of areas can be classified, lands are separated into "physiographic provinces" with common distinguishing landscape characteristics such as land and rock formations, vegetative cover, and surface water features. The Butte District has four physiographic provinces: the Broad Valley Rockies, the Columbia Rockies, the Yellowstone Rockies, and the Rocky Mountain Foreland. The characteristics of these provinces are described in *Landscape Character Types for National Forests of the Northern Region* (U.S. Department of Agriculture, Forest Service, 1970), which is available from the Regional Office of the Forest Service at Missoula, Montana.

If these frames of reference were not used in determining scenic quality, it is possible that some rather large geographical areas would be classified as having minimal scenic quality. Such a classification could allow the landscape to be modified to the extent that few remnants of the natural-appearing characteristics would remain.

Scenic Quality

Scenic quality in the Butte District has been divided into three classes: A, high scenic values; B, moderate scenic values, and C, low scenic values (see the Visual Resources map). Generally lands of high scenic values (Class A) have a landscape character of either high, rugged, forested mountains; tree-lined and/or gorged river bottoms, or major lakes. Lands of low scenic values (Class C) have a landscape character of broad, flat, or rolling valley bottoms or foothills with little vegetation and few water features; or they are plains landscape. Those lands with a landscape character that falls somewhere in between A and C have moderate scenic values and are classified Class B.

CULTURAL RESOURCES

The cultural resources in western Montana are not well known because cultural resource investigation has been very limited. Even though hundreds of sites have been recorded, information from many of these records is not adequate to evaluate the sites or even to locate them again.

Since little is known of western Montana's cultural resources, sites that may yield information—generally those containing material that can be dated—are very significant. Because of the poor recording efforts of the past, it is not known if many of the reported sites fall into this category.

The density of sites does not appear to be great in any specific area of the district; however, the east side of the Continental Divide seems to have a greater number of prehistoric sites than the west side. This observation may be only the result of vegetation patterns—the east side is more open and the ground surface is more visible, while tree litter and undergrowth obscure most of the ground west of the divide.

Sites from Montana's early historic periods are more plentiful in the Butte District, because this is where most of Montana's early mining activity took place. However, most of the highly significant sites are privately owned, since successful mining generally leads to land and mineral patents.

THE SOCIOECONOMIC ENVIRONMENT

ECONOMIC AND SOCIAL CONDITIONS

The Butte District is a mixture of urban and rural populations. More than half of the population of Montana lives in this district.

Population

Preliminary figures indicate that the 1980 population of the Butte District is 476,974, an increase of 14.6% since 1970. An additional 5.6% increase is expected in the area by 1985. The largest population increases are expected to occur in areas where the rate of growth is now high. The Helena and Missoula areas are likely to have the highest growth rates in the period from 1980 to 1990. Population figures are summarized in Table 4-1.

Employment

Total employment levels in the study area increased approximately one-third between 1971 and 1981 (see Table 4-2). Individual county employment rates during the period ranged from a loss of 29.5% in Lincoln County to an increase of 54.4% in Lewis and Clark County. There are few oil and gas workers in the area; the majority of these are in Teton and Pondera counties.

Personal Income

Per capita personal income in 1977 was above the state average in only six counties in the Butte District: Cascade, Flathead, Lewis and Clark, Missoula, Pondera, and Silver Bow.

Public Finance

As in the rest of the state, counties and public schools in the district depend heavily on property taxes. Taxable value and assessed values are generally high in comparison with other areas of the state (see Table 4-3). High property valuations within counties provide flexibility to increase tax revenue. The ability to increase taxes can help communities to meet new demands placed upon the local infrastructure.

A major source of local government income comes in the form of intergovernmental transfers, primarily as federal revenue sharing funds. There currently is some discussion in Congress to reduce or eliminate this program, which would have a major effect on local government finances.

Table 4-4 shows production, gross value, and amounts taxable for oil and gas in Pondera and Teton counties. These are the only counties in the Butte District where oil and gas production is being carried out.

Infrastructure

Infrastructure capacity within the district varies widely from county to county and from city to city. Areas that have rural population tend to have less capacity for major population increases.

Each of the counties in the district has at least one hospital. Six hospitals have occupancy rates of more than 50%; only one has an occupancy rate greater than 70%. The number of beds available per county ranges from a low of 6 in Meagher county to a high of 472 in Cascade county.

School enrollment in the study area dropped from 104,113 in 1970 to 101,489 in 1975. This would indicate an ability of some counties to absorb an increase in enrollment.

Housing units in 1970 for each county showed from 119 vacant units to 1,874 vacant units. Much of the housing in the counties with small population was constructed before 1950. Between 3% and 29% of the units in these counties lacked some or all plumbing facilities in 1970. Therefore, while the stock of housing may be sufficient for a population influx, the quality of existing housing may necessitate some building of new structures or the increased use of mobile homes.

TABLE 4-1

POPULATION ESTIMATES

County/Community	1970	1980	Percentage of Change between 1970 and 1980
Beaverhead	8,187	8,204	+ 0.3
Dillon	4,548	3,980	- 12.4
Lima	351	271	- 22.8
Broadwater	2,526	3,263	+ 29.1
Townsend	1,371	1,586	+ 15.7
Cascade	81,804	80,639	- 1.4
Great Falls	60,091	56,568	- 5.9
Deer Lodge	15,652	12,507	- 20.1
Anaconda[a]	9,771	12,507	—
Flathead	39,460	51,462	+ 30.4
Kalispell	10,526	10,299	- 2.2
Whitefish	3,349	3,582	+ 6.9
Gallatin	32,505	42,821	+ 31.7
Bozeman	18,670	21,611	+ 15.8
Granite	2,737	2,691	- 1.7
Drummond	494	410	- 1.7
Philipsburg	1,128	1,131	+ 0.26
Jefferson	5,238	7,040	+ 34.4
Boulder	1,342	1,439	+ 7.2
Whitehall	1,035	1,040	+ 0.48
Lake	14,445	19,098	+ 32.2
Polson	2,464	2,840	+ 15.3
Ronan	1,347	1,528	+ 13.4
Lewis and Clark	33,281	43,053	+ 29.4
Helena	22,730	23,818	+ 4.8
Lincoln	18,063	17,731	- 1.8
Libby	3,286	2,748	- 16.4
Madison	5,014	5,437	+ 8.4
Ennis	501	660	+ 31.7
Meagher	2,122	2,145	- 1.1
White Sulphur Springs	1,200	1,298	+ 8.2
Mineral	2,958	3,674	+ 24.2
Alberton	363	379	+ 4.4
Superior	993	1,052	+ 5.9
Missoula	58,263	75,432	+ 29.5
Missoula	29,497	32,841	+ 11.3
Park	11,197	12,682	+ 13.3
Livingston	6,883	6,998	+ 1.7
Pondera	6,611	6,735	+ 1.9
Conrad	2,770	3,074	+ 11.0
Powell	6,660	6,939	+ 4.2
Deer Lodge	4,306	4,011	- 6.8
Ravalli	14,409	22,427	+ 55.6
Hamilton	2,499	2,657	+ 6.3
Sanders	7,093	8,559	+ 20.7
Plains	1,046	1,076	+ 2.9
Thompson Falls	1,356	1,470	+ 8.4
Silver Bow	41,981	37,950	- 9.6
Butte[b]	23,368	37,064	—
Teton	6,116	6,485	+ 6.0
Choteau	1,586	1,789	+ 12.8
Montana	694,409	783,698	+ 12.85
22-county total	416,322	476,974	+ 14.6

Source: United States Department of Commerce, Bureau of the Census, Preliminary Report: 1980 Census of Population and Housing, Montana (1980).

a. City and county governments were combined before 1980.

b. City and county governments were combined in May 1977.

TABLE 4-2

EMPLOYMENT STATISTICS

County	Number Employed in February 1971	Number Employed in February 1981	Percentage of Change
Beaverhead	3,052	3,740	+ 22.5
Broadwater	941	1,157	+ 22.9
Cascade	27,452	31,318	+ 14.1
Deer Lodge	5,571	3,925	- 29.5
Flathead	12,900	19,616	+ 52.1
Gallatin	12,775	17,566	+ 37.5
Granite	888	1,020	+ 14.9
Jefferson	1,768	2,144	+ 21.3
Lake	4,615	6,573	+ 42.4
Lewis and Clark	14,971	23,122	+ 54.4
Lincoln	5,596	5,290	- 5.5
Madison	1,820	1,986	+ 9.1
Meagher	814	918	+ 12.8
Mineral	1,167	1,622	+ 39.0
Missoula	21,664	32,726	+ 33.8
Park	4,346	5,024	+ 15.6
Pondera	2,461	3,221	+ 30.8
Powell	2,346	3,343	+ 42.5
Ravalli	4,792	6,172	+ 28.8
Sanders	2,639	3,416	+ 29.4
Silver Bow	14,717	17,060	+ 15.9
Teton	2,176	2,448	+ 12.5
22-county total	149,471	193,407	+ 29.4
Statewide total	250,826	334,862	+ 33.5

SOURCE: Montana Department of Labor and Industry.

TABLE 4-3
ASSESSED AND TAXABLE VALUE

County	1977 Total Assessed Value	1977 Total Taxable Value	1978 Total Assessed Value	1978 Total Taxable Value
Beaverhead	62,810,011	16,811,472	139,066,279	15,037,718
Broadwater	25,809,595	6,660,961	58,481,822	6,611,159
Cascade	365,423,096	91,805,261	1,012,212,959	93,132,967
Deer Lodge	84,771,532	19,424,346	240,242,755	18,506,070
Flathead	245,715,727	63,152,497	819,750,222	77,720,622
Gallatin	186,785,757	48,314,017	527,343,788	52,065,131
Granite	19,240,337	5,465,997	45,983,571	5,291,971
Jefferson	30,575,642	9,143,521	77,417,887	8,822,078
Lake	88,760,969	23,087,408	277,033,664	26,401,594
Lewis and Clark	198,738,385	50,929,643	560,993,089	53,575,890
Lincoln	82,749,617	20,976,978	241,194,607	26,104,221
Madison	50,087,348	15,255,326	120,155,885	14,730,846
Meagher	19,260,755	5,313,839	42,274,586	5,007,282
Mineral	17,388,464	4,334,540	45,541,987	4,785,040
Missoula	353,383,396	87,901,409	1,223,890,007	115,362,499
Park	61,515,655	16,469,741	165,597,075	16,428,153
Pondera	70,293,383	19,425,368	134,875,388	18,689,460
Powell	36,231,553	10,209,289	98,973,123	11,560,321
Ravalli	84,194,369	21,291,688	218,630,979	21,861,131
Sanders	64,293,638	17,657,683	175,753,213	18,834,908
Silver Bow	243,463,010	51,964,412	629,468,085	54,809,895
Teton	64,501,861	17,019,102	122,971,722	16,172,331
Total	2,455,994,100	622,614,498	8,945,522,693	681,511,287
Statewide total	5,105,825,522	1,466,743,754	13,103,720,390	1,568,285,437
Percentage of total Montana values in Butte District	48.0%	42.4%	68.3%	43.4%

SOURCE: Report of the Montana Department of Revenue, July 1, 1976, to June 30, 1978.

TABLE 4-4

OIL AND GAS PRODUCTION AND TAXABLE AMOUNTS
1977 Production; 1978 Taxable Amounts

Oil	Barrels	Gross Value	Total Amount Taxable
Pondera	329,059	$4,473,422	$2,283,806
Teton	106,754	$1,473,504	$ 950,364

Gas	Million Cubic Feet	Gross Value	Total Amount Taxable
Pondera	618,153	469,036	$ 350,666
Teton	3,635,582	3,165,672	$2,393,623

	Total Taxable Assessed Valuation from All Sources	Percentage of Total Contributed by Oil and Gas
Pondera	$18,689,460	14%
Teton	$16,172,331	21%

SOURCE: Montana Department of Revenue, Report of the State Department of Revenue for the Period July 1, 1976, to June 30, 1978.

THE ROCKY MOUNTAIN FRONT

An area of special concern in this assessment is the Rocky Mountain Front, which is becoming a high priority exploration prospect within the Overthrust Belt in Montana. The name "Rocky Mountain Front" describes an area from Montana Highway 200 north to the Blackfoot Indian Reservation. It reaches east from the Continental Divide to approximately 10 miles east of the boundary of the Lewis and Clark National Forest.

The area, which is mostly undeveloped, is rich in wildlife and in wilderness and recreational values. Portions of the Bob Marshall and Great Bear Wilderness areas are within the Rocky Mountain Front, as are several Forest Service and BLM wilderness study areas and three winter game ranges of the Montana Department of Fish, Wildlife, and Parks. Most of the area is essential habitat for grizzly bear, and it also supports populations of bighorn sheep, mountain goat, mule deer, elk, and black bear. Recreational pursuits include big game hunting, backpacking, ORV use, fishing, and sightseeing.

Both the Forest Service and the BLM manage lands in the Rocky Mountain Front area, and there are thousands of acres of private surface underlain by federal minerals. State land is managed by the Montana Department of Fish, Wildlife, and Parks and the Montana Department of State Lands. Governments for Pondera, Teton, and Lewis and Clark counties are involved.

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best copy available

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REFERENCES

Beer, James
1943 "Food Habits of the Blue Grouse." *Journal of Wildlife Management* 7:32-44.

Bendell, J. F.
1955 "Age, Breeding Behavior, and Migration of Sooty Grouse (*Dendragapus obscurus fuliginosus* [Ridgeody])." *Transactions of the North American Wildlife Conference* 20:367-381.

Day, G.
1978 "Wolves of Montana." M.S. thesis, University of Montana, Missoula.

Day, T. A.
1973 "Summer and Fall Elk Distribution, Movements, and Range Use in the Little Belt Mountains." M.S. thesis, Montana State University, Bozeman.

Dorn, R. D.
1969 "Relations of Moose, Cattle, and Willows in Southwestern Montana." M.S. thesis, Montana State University, Bozeman.

Duncan, E. A.
1975 "The Ecology of Curl-leaf Mountain Mahogany (*Cercocarpus ledifolius* [Nutt.]) in Southwestern Montana: with Special Reference to Use by Mule Deer." M.S. thesis, Montana State University, Bozeman.

Ericson, G. L.
1972 "The Ecology of Rocky Mountain Bighorn Sheep in the Sun River Area of Montana: with Special Reference to Summer Food Habits and Range Movements." M.S. thesis, Montana State University, Bozeman.

Eustace, C. D.
1967 "Food Habits, Range Use and Relationships between Elk and Livestock in the Gravelly Mountains, Montana." M.S. thesis, Montana State University, Bozeman.

Frisina, Michael R.
1974 "Ecology of Bighorn Sheep in the Sun River Area of Montana During Fall and Spring." M.S. thesis, Montana State University, Bozeman.

Geist
1975 *Mountain Sheep and Man in the Northern Wilds.* Ithaca, NY: Cornell University Press.

Hausenbuiller, R. L.
1972 *Soil Science Principles and Practices.* William C. Brown Company.

Jonkel, Charles
1976 Annual Report No. 1: Border Grizzly Project. Missoula, MT: University of Montana, School of Forestry.

Kirsch, J. B.
1962 "Range Use, Relationship to Logging, and Food Habits of the Elk in the Little Belt Mountains, Montana." M.S. thesis, Montana State University, Bozeman.

Knight, R. R.
1970 *The Sun River Elk Herd.* Wildlife Monograph no. 23. Washington: Wildlife Society.

Knowlton, F. F.
1959 "Food Habits, Movements, and Population Structure of Moose in the Gravelly Mountains, Montana." M.S. thesis, Montana State University, Bozeman.

Lonner, Terry N.
1974 "Long Tom Creek Study: Elk Use and Distribution." Cooperative Elk-logging Study Progress Report.

Marcum, C. L.
1975 "Summer-fall Habitat Selection and Use by a Western Montana Elk Herd." Ph.D. dissertation, University of Montana, Missoula.

Marshall, W. H.
1946 "Cover Preferences, Seasonal Movements, and Food Habits of Richardson's Grouse and Ruffed Grouse in Southern Idaho." *Wilson's Bulletin* 58:42-52.

Martin, N. S.
1970 "Sagebrush Control Related to Habitat and Sage Grouse Occurrence." *Journal of Wildlife Management* 34:313-320.

Martinka, R. R.
1970 "Structural Characteristics and Ecological Relationships of Male Blue Grouse (*Dendragapus obscurus* [Say]) Territories in Southwestern Montana." Ph.D. dissertation, Montana State University, Bozeman.

1972 "Structural Characteristics of Blue Grouse Territories in Southwestern Montana." *Condor* 36:498-510.

Mattson, Ursula; and Ream, Robert R.
1978 *Current Status of the Gray Wolf* (Canis lupis) *in the Rocky Mountain Front.* Wolf Ecology Project. Missoula: University of Montana.

Montana, Department of Fish and Game.
1971 *Game Management in Montana.* Helena.

1974 *Ecology of Shiras Moose in Montana,* by P. Schladweiler. Job final report, projects W-98-R and W-120-R. Helena.

Montana Department of Fish, Wildlife, and Parks.
1979 Annual Report: East Slope Rocky Mountain Front Mule Deer Study and Inventory. Helena.

Montana Geological Society
1979 *Sun River-Teton Canyon: Montana Disturbed Belt.* Thirtieth Anniversary Field Conference guidebook.

Montana State University
1973 *Soils in Montana.* Bulletin 621. Bozeman.

Mussehl, T. W.
1960 "Blue Grouse Production, Movements, and Populations in the Bridger Mountains, Montana." *Journal of Wildlife Management* 24(1):60-68.

1963 "Blue Grouse Brood Cover Selection and Land-use Implications." *Journal of Wildlife Management* 27(4):546-555.

Myers, Lewis H.
1978 Personal communication.

Myers is a wildlife management biologist in the Dillon Resource Area, Bureau of Land Management.

Nagy, J. A.; and Russell, R. H.
1978 *Ecological Studies of the Boreal Forest Grizzly Bear* (Ursus arctos H.): *Annual Report for 1977.* Ottawa: Canadian Wildlife Service.

Peek, J. M.
1961 "Reproduction of Moose in Southwestern Montana." M.S. thesis, Montana State University, Bozeman.

Reichelt, L. R.
1973 "Characteristics of Elk Calving Sites Along the West Fork of the Madison River." M.S. thesis, Montana State University, Bozeman.

Rouse, R. A.
1957 "Elk Food Habits, Range Use, and Movements: Gravelly Mountains, Montana." M.S. thesis, Montana State University, Bozeman.

Schallenberger, A.
1966 "Food Habits, Range Use, and Interspecific Relationships of Bighorn Sheep in the Sun River Area, West-central Montana." M.S. thesis, Montana State University, Bozeman.

1976 *Grizzly Bear Habitat Survey, Badger Creek-South Fork-Two Medicine Management Unit.* Great Falls, MT: Lewis and Clark National Forest, Forest Service, U. S. Department of Agriculture.

Schallenberger, A.; and Jonkel, Charles D.

1978 Rocky Mountain East Front Grizzly Studies, 1977: Annual Report. Special Report no. 18, Border Grizzly Project, School of Forestry. Missoula, MT: University of Montana.

1979 Rocky Mountain East Front Grizzly Studies, 1979: Annual Report. Special Report no. 27, Border Grizzly Project, School of Forestry. Missoula, MT: University of Montana.

1980 Rocky Mountain East Front Grizzly Studies, 1980: Final Report, Border Grizzly Project, School of Forestry. Missoula, MT: University of Montana.

South, P. R.

1975 "Food Habits and Range Use of the Mule Deer in the Scudder Creek Area, Beaverhead County, Montana." M.S. thesis, Montana State University, Bozeman.

United States. Department of Agriculture. Forest Service.

1977a *Rocky Mountain Front Planning Unit: Draft Environmental Statement.* Great Falls, MT: Lewis and Clark National Forest.

1977b *Forest Habitat Types of Montana,* by Robert D. Pfister, Bernard L. Kovalchik, Stephen F. Arno, and Richard C. Presby. General Technical Report INT-34. Ogden, UT: Intermountain Forest and Range Experiment Station.

1980 *Grassland and Shrubland Habitat Types of Western Montana,* by W.F. Mueggler and W.L. Stewart. General Technical Report INT-66. Ogden, UT: Intermountain Forest and Range Experiment Station.

United States. Department of Commerce. Bureau of the Census.

1977 *City-County Data Book.* Washington.

United States. Department of the Interior. National Park Service.

1975 *The History and Status of Wolves in Northern Glacier National Park, Montana,* by F.J. Singer. Glacier National Park Scientific Paper no. 1. West Glacier, MT.

1978 *The Wolves of Yellowstone,* by J.L. Weaver. National Resources Report no. 14. Washington: U.S. Government Printing Office.

Werner, T.; and Jonkel, Charles

1977 "Grizzly Dens in the Border Grizzly Area." Annual Report no. 2, Border Grizzly Project, School of Forestry. Missoula, MT: University of Montana.

APPENDIXES 1- 5

APPENDIX 1: ASSUMPTIONS AND BACKGROUND INFORMATION

Some physical and operational characteristics of drilling facilities in Montana and the Dakotas are described below. For analytical purposes, the assumption has been made that any leasing operation may result in oil and gas production. Historically, however, only a small percentage of operations has reached the production stage. The assumptions and information in the following paragraphs will be useful in the analysis of the potential impacts of oil and gas development.

TECHNOLOGY

For the purposes of analysis, it has been assumed that the technology of oil and gas production will not change significantly. This assumption may not be objectively valid, but it is difficult to determine what direction improved technology may take in the future.

SUPPLY AND DEMAND

Among the factors that could significantly affect oil and gas activity in the study area are increases or decreases in the demand for domestic oil and gas and discovery of a major oil or gas field in the area. The demand could decrease if new energy sources were developed; it also could increase because of export restrictions imposed by foreign oil and gas suppliers or because of import restrictions imposed by the United States.

Since there is no way to predict these possible changes accurately, we have assumed that supply, demand, and production activity will follow current trends.

PRELIMINARY EXPLORATION

Preliminary exploration activity is expected to increase at a rate of about 10% per year, with most activity in the deep formations. As the demand for petroleum products increases, we expect that exploratory drilling will increase about 15% per year in the deep formations and on the fringes of existing fields.

We expect development to continue at about the current level as existing fields are further exploited. Production has decreased about 2% per year over the last several years as reserves have been depleted; we expect this trend to continue.

Abandonments are expected to increase at a rate of about 5% per year as older fields are depleted.

LAND FOR PRODUCING FACILITIES

The intensity of land use decreases as well spacing increases. A minimum of 40 acres per well is usually required for oil wells on federal leases. Although the amount of land actually used may be greater in some areas and less in others, facilities in a developed field may occupy about 64 acres of each square mile if the spacing is 40 acres per well. If the spacing is 640 acres per well, facilities may occupy about 4 acres of each square mile. These acreages are adequate for most field operations.

Less land is usually required for facilities in gas fields than in oil fields because gas production usually does not require storage on the leased area. The spacing required for production of gas on most federal leases is 160, 320, or 640 acres per well.

EMPLOYMENT

The number of people required to operate a field varies with production and the number of leaseholds in the field. If the wells flow without pumping, one employee in a large automated field can control the production of about 25 wells. When wells are pumped, one employee in a large modern field can control the production of 10 to 20 wells. If oil storage tanks are manually gauged and sampled, one employee can service approximately 25 tanks; if automatic gauging and sampling devices have been installed, one person can service the equivalent of 100 to 150 tanks. In a large, modern field, one five-person maintenance crew can service up to 50 wells.

APPENDIX 2: PROCESSING OF LEASE APPLICATIONS

Approximately 150 lease applications are processed by the Butte District office each year. A lease application originates in the Montana State Office when a party applies for an oil and gas lease on a particular parcel of land. The application is then forwarded to the appropriate district office.

When an application is sent to the Butte District office, a file card is typed and the lease application is sent to the appropriate resource office, where it is reviewed by wildlife biologists, recreation planners, surface protection specialists, soil scientists, and other specialists as needed. When the lease is reviewed, it is assumed that the area will be developed as outlined in Chapter 1 and that impacts as described in Chapter 2 will result from development.

Each resource specialist reviews the lease for impacts to that particular resource. In the Dillon Resource Area, a recently completed MFP is consulted for information on crucial wildlife habitat, sensitive soils, and prime recreation areas. In other parts of the district, where detailed planning information is lacking, an onsite field review usually will be required. Land use plans are scheduled for completion in the Headwaters Resource Area in 1983 and in the Garnet Resource Area in 1985.

Specialists reviewing a lease application will complete the checklist and, if necessary, the supplemental forms at the end of this appendix. Information from the completed checklist and supplemental forms will indicate what stipulations will be needed. Information for completion of the checklist may be drawn from this environmental analysis, existing and future land use plans, county soils maps, wildlife research data, onsite review, and consultation with state agencies, other federal agencies, and local government offices.

Before completing the checklist or contacting other agencies, involved specialists should review instruction memorandum MT-78-223 (9/28/78). This memo outlines BLM policy on stipulation use and interagency review.

After the checklist and resulting stipulations are completed, the lease application file is sent back to the Butte District office for review. If the lease application involves Montana state lands or federal lands administered by other agencies, a copy is sent to the appropriate agency for a 30-day review.

When the lease application has been completely reviewed, the Butte District's recommendation and all supporting documents are sent to the Montana State Office, where the lease is issued.

BUTTE DISTRICT OIL AND GAS LEASING CHECKLIST

OG Sim. Serial Number _____ Serial Number _____

Resource Area _____ Planning Unit _____

Land use plan used for reference _____ (name) _____ (date)

INTERAGENCY COORDINATION

_____ Initial 1. Is any surface ownership of any agency listed in the lease area? _____No _____Yes (Check which)
_____FS _____ Montana DSL _____ WPRS _____ MDFWP _____ USFWS

Local government (Name) _____

Other (Name) _____

_____ Initial 2. Forest Service. Which national forest? _____

Has resource area contacted forest supervisor or ranger to agree on coordinated stipulations? _____Yes _____No

Attach documentation. District office has sent stips and checklist to forest supervisor.

_____ Date Sent _____ To Whom

_____ Initial (Dist. Off.)

_____ Initial 3. U.S. Fish and Wildlife Service. Which USFWS area? _____

Has resource area contacted local office for recommendations? _____Yes _____No. Attach documentation. Are stipulations and maps from USFWS attached? _____Yes _____No. District Office has sent stips and checklist to appropriate FWS office.

_____ Date Sent _____ To Whom

_____ Initial (Dist. Off.)

_____ Initial 4. WPRS. Name project area _____

Has resource area or MSO contacted appropriate office for recommendations? _____Yes _____No. Attach documentation. Are stipulations and maps from WPRS attached? _____Yes _____No. District office has sent stips and checklist to appropriate WPRS office.

_____ Date Sent _____ To Whom

_____ Initial (Dist. Off.)

OG Sim. Serial Number _____ **Serial Number** _____

_____ Initial

5. MDFWP (includes fishing access sites, game ranges, etc.). Name of area and MDFWP region number _____ _____.

Has resource area contacted appropriate local MDFWP personnel for recommendations? _____Yes _____No. Attach documentation. Are stipulations and maps from MDFWP local coordination attached? _____Yes _____No. District office has sent stips and checklist to MDFWP Regional Office for 30 day comment period beginning _____ Date _____ Initial (Dist. Off.)

Attach documentation of response from MDFWP regional office _____ Initial (Dist. Off).

6. Montana Department of State Lands (DSL). Has resource area contacted State Lands personnel for recommendations? _____Yes _____No. District Office has sent stips and checklist to DSL (Helena) for 30-day comment period beginning _____ Date _____ Initial (Dist. Off)

Attach documentation of DSL response _____ Initial (Dist. Off.)

_____ Initial

7. Local government. Name of government unit _____

Has resource area contacted county or city government for recommendations? _____Yes _____No Attach documentation and recommendations, if any.

STIPULATIONS AND RECOMMENDATION

Specialists completing this checklist must be aware of the terms of standard stipulations (which are on every lease) and the Controlled or Limited Use Stipulation.

Program	Std and Controlled Use Stips Adequate	Special Stip(s) Needed	Recommended by	Date
Minerals				
Forest Management				
Realty				
Hydrology				
Soils				
Range Management				
Wildlife				
Fisheries				
Threatened & Endangered Species				
Recreation				
Wilderness				

OG Sim. Serial Number _____ **Serial Number** _____

If special stipulations are needed, complete the necessary supplemental sheets and attach them along with stipulation sheets, rationale, and maps as necessary.

Recommendation to: lease _____ (all or part) deny _____ (all or part)

Stipulations needed: ☐ Standard ☐ Controlled Use ☐ Special ☐ Other _____

SUMMARY AND SIGNATURES

Do the programmatic EAR and this checklist constitute an adequate environmental assessment? _____Yes _____No

If not, what do you recommend? _____

_____

Checklist completed by _____ Name _____ Date

Approved by Area Manager _____ Name _____ Date

Reviewed by District staff _____ Name _____ Date

_____ Name _____ Date

_____ Name _____ Date

Approved by District Manager (Including decision on adequate level of environmental analysis) _____ Name _____ Date

CHECKLIST SUPPLEMENT
Butte District Oil and Gas Leasing Checklist

OG Sim. Serial Number _____ **Serial Number** _____

INSTRUCTIONS FOR USE

Consider carefully whether seasonal or "no occupancy" stips are required and whether stip should apply to production or exploration only. Specialists completing this checklist must be aware of standard stipulations and approved special stipulations and must initial the questions as they are completed. Also indicate if maps are attached.

Use the supplemental sheets only when the checklist indicates a need for a special stipulation for a resource. In cases where a lease applicant wants specific special stipulations instead of the controlled use stipulation, fill out the entire checklist.

When describing a stipulation on a supplemental sheet, briefly outline it using one of the approved stips. Otherwise, write it out exactly as desired. Be sure to include correct legal descriptions if necessary. Percentage figure is percent of total lease acreage. All maps will be USGS quads. A recommendation to deny a lease will be listed on stipulation entry. Identify special stipulations by stip name or form number. If additional blank sheets are used in conjunction with a supplemental sheet, be sure to reference the resource and item number (example: WILDLIFE--BIG GAME--#2).

Supplemental sheet 1
Butte District Oil and Gas Checklist

MINERALS

____ Initial
____ Map

1. Are any unpatented mining claims or active mining operations currently recorded in the lease area? _____Yes _____No

Are any problems anticipated that would require a stipulation? _____Yes _____No

Explain _____

_____

Stipulation _____

_____

(% of lease area)

Rationale attached _____Yes _____No

____ Initial
____ Map

2. Are there any existing mineral leases on the lease area? _____Yes _____No

Describe _____

_____

Are any problems anticipated that would require a stipulation? _____Yes _____No

Explain _____

_____

Stipulation _____

_____

(% of lease area)

Rationale attached _____Yes _____No

____ Initial
____ Map

3. Are any saleable minerals being developed on the lease area (community pit)? _____Yes _____No

Describe _____

_____

Are any problems anticipated that would require a stipulation? _____Yes _____No

Explain _____

_____

Stipulation _____

_____

(% of lease area)

Rationale attached _____Yes _____No

Supplemental sheet 2
Butte District Oil and Gas Checklist

FOREST MANAGEMENT

_____ Initial 1. Does application include commercial forestland? _____Yes _____No

_____ Map 2. Is area involved in 5-year sale plan? _____Yes _____No

3. Is area in a completed CMP? _____Yes _____No

Name of CMP _____

_____ Initial 4. Describe any management areas or other considerations requiring lease stipulations (seed orchards, thinnings, etc.).

_____

_____

_____ Map Stipulation _____

_____

(% of lease area)

Rationale attached _____Yes _____No

_____ Initial 5. Should new road locations be reviewed at APD time to coordinate with coordinate with forest management access plans? _____Yes _____No

REALTY

_____ Initial 1. Are there any existing permits, rights-of-way, etc., granted in the lease area? _____Yes _____No

Describe _____

_____ Map

_____

_____

Are any stipulations required? Explain _____

_____

_____

Stipulation _____

_____

(% of lease area)

Rationale attached _____Yes _____No

2. Are there any pending actions such as tenure adjustments that might be affected by leasing? _____Yes _____No

Describe, and if a stipulation is required, explain:

_____

_____

Stipulation _____

_____

(% of lease area)

Rationale attached _____Yes _____No

Supplemental sheet 3
Butte District Oil and Gas Checklist

WATERSHED

_____ Initial
_____ Map

1. Are there any soil conditions (unstable, steep slope, highly erosive, rehabilitation problems, etc.) that require stipulations other than the standard erosion stipulation on MSO form 3100-47? _____Yes _____No. If yes, map and describe: _____

Rationale attached _____Yes _____No

Stipulation _____

(% of lease area)

Rationale attached _____Yes _____No

_____ Initial
_____ Map

2. Are there water quality considerations (municipal watershed, erosion, stream setbacks, chemical pollution, etc.) which require stipulations? _____Yes _____No. If yes, map and describe (rationale):

Stipulation _____

(% of lease area)

Rationale attached _____Yes _____No

RANGE MANAGEMENT

_____ Initial

1. Is the lease area within an allotment? _____Yes _____No

Name of allotment _____

AMP or non-AMP? _____

_____ Initial
_____ Map

2. Will oil and gas action affect the operation of the AMP? (consider improvements, study plots, exposure to chemicals, trailing routes, etc.) _____Yes _____No

If yes, how? _____

Stipulation _____

(% of lease area)

Rationale attached _____Yes _____No

_____ Initial

3. Is coordination necessary at time of APD? _____Yes _____No

Describe _____

Supplemental sheet 4
Butte District Oil and Gas Checklist

WILDLIFE--BIG GAME (Includes elk, deer, moose, antelope, mountain goat, bighorn sheep.)

_____ Initial 1. Complete the table for big game species known to use the lease area. Do not include T&E species. All habitat areas requiring a stipulation must be mapped.

_____ Map

Species	Type of Use	Season/Dates	Stipulation Needed Exploration	Prod.	Source of Data

Use more than one line for a species if appropriate. Indicate if none. For type of use, list occasional, normal or crucial. For source of data, list land use plan, MDFWP, field review, etc. Put rationale on separate sheet. Reference species.

Species _____ Stipulation _____

_____ (% of lease area)

Rationale attached _____Yes _____No

Species _____ Stipulation _____

_____ (% of lease area)

Rationale attached _____Yes _____No

Species _____ Stipulation _____

_____ (% of lease area)

Rationale attached _____Yes _____No

WILDLIFE--NONGAME (Includes small mammals, birds, raptors, reptiles, furbearers, etc).

_____ Initial 1. Complete the table for any unique or special nongame wildlife using the lease area. Do not include T&E species. All nesting sites and other habitat areas requiring a stipulation must be mapped.

_____ Map

Species	Type of Use	Season/Dates	Stipulation Needed Exploration	Prod.	Source of Data

Wildlife—nongame (continued)

Use more than one line for a species if appropriate. Indicate if none or if species is listed for concern by MDFWP. For type of use, list occasional, normal, crucial, nesting, etc. For source of data, list land use plan, MDFWP, field review, etc. Put rationale on separate sheet. Reference species.

Species _____ Stipulation _____

_____
(% of lease area)

Rationale attached _____Yes _____No

Species _____ Stipulation _____

_____
(% of lease area)

Rationale attached _____Yes _____No

WILDLIFE--GAME BIRDS (Includes ducks, geese, grouse, other upland game birds.)

_____ 1. Complete the table for any waterfowl or upland game birds using the lease area. Do not include T&E species. All
Initial nesting areas, strutting grounds and other habitat areas requiring a stipulation must be mapped.

_____
Map

Species	Type of Use	Season/Dates	Stipulation Needed		Source of Data
			Exploration	Prod.	

Use more than one line for a species if appropriate. Indicate if none or if species is listed for concern by MDFWP. For type of use, list occasional, normal, crucial, nesting, strutting, etc. For source of data, list land use plan, MDFWP, field review, etc. Put rationale on separate sheet. Reference species.

Species _____ Stipulation _____

_____
(% of lease area)

Rationale attached _____Yes _____No

Species _____ Stipulation _____

_____
(% of lease area)

Rationale attached _____Yes _____No

Supplemental sheet 6
Butte District Oil and Gas Checklist

WILDLIFE--FISHERIES

_____ Initial 1. Is any portion of the lease within 1,000 feet of perennial water? _____Yes _____No

_____ Map If yes, is the water a fishery? _____Yes _____No

If yes, complete table.

Species	Class of Fisheries (I to VI)	Season/Dates	Stipulation Needed Exploration	Prod.	Source of Data

Use more than one line for a species if appropriate. Indicate if none or if species is listed for concern by MDFWP. For type of use, list occasional, normal, crucial, spawning, etc. For source of data, list land use plan, MDFWP, field review, etc. Put rationale on separate sheet. Reference species.

Species _____ Stipulation _____

_____

(% of lease area)

Rationale attached _____Yes _____No

Species _____ Stipulation _____

_____

(% of lease area)

Rationale attached _____Yes _____No

Required buffer strip each side of stream: Class I=1,000 ft.; Classes II and III=500 ft.; Classes IV to VI=300 ft.

Supplemental sheet 7
Butte District Oil and Gas Checklist

THREATENED AND ENDANGERED PLANTS AND ANIMALS

If T&E species occur, consider using T&E stip as well as other stipulations.

_____ 1. Are any T&E plants thought or known to occur on the lease area? _____Yes _____No. If yes, list species and map.
Initial

_____ _____
Map

Is consultation with USFWS required to develop stipulation or decide on leasing?

_____No _____Yes (informal) _____Yes (formal)

If yes, attach documentation of consultation. Put stipulation rationale on separate sheet.

Species _____ Stipulation _____

_____
(% of lease area)

Rationale attached _____Yes _____No

_____ 2. Are any T&E animals (grizzly, wolf, bald eagle, etc.) using the lease area? _____Yes _____No. If yes, complete table and map.
Initial

_____
Map

Species	Type of Use	Season/Dates	Stipulation Needed		Source of Data
			Exploration	Prod.	

Use more than one line for a species if appropriate. Indicate if none or if species is listed for concern by MDFWP. For type of use, list occasional, normal, crucial, nesting, etc. For source of data, list land use plan, MDFWP, field review, etc. Reference species. Is consultation with USFWS required to develop stipulations or to decide on leasing? _____No _____Yes (informal) _____Yes (formal). If yes, attach documentation of consultation. Put stipulation rationale on separate sheet.

Species _____ Stipulation _____

_____
(% of lease area)

Rationale attached _____Yes _____No

Species _____ Stipulation _____

_____
(% of lease area)

Rationale attached _____Yes _____No

Supplemental sheet 8
Butte District Oil and Gas Checklist

RECREATION

_____ Initial

1. Are there any high use areas such as campgrounds, hunting camps, etc., on the lease area or that could be influenced by activities of a lease? _____Yes _____No. If yes, map and describe:

_____ Map

_____

_____

Stipulation _____

_____

(% of lease area)

Rationale attached _____Yes _____No

_____ Initial

2. Is lease area within an area designated closed to ORV use? _____Yes _____No. Is lease area within an area designated for limited ORV use? _____Yes _____No. If lease operations would be affected, map and list: Season of closure _____, type of use restricted (trucks, bikes, etc.) _____ _____, name of closure area _____.

_____ Map

Stipulation _____

_____

(% of lease area)

Rationale attached _____Yes _____No

_____ Initial

3. Does the lease area include a travel zone (highway, river, trail, etc.) which would require a stipulation for reasons other than visual impacts? _____Yes _____No. If yes, describe:

_____ Map

_____

_____

Consider seasonal or no-occupancy buffer and whether production should be included.

Stipulation _____

_____

(% of lease area)

Rationale attached _____Yes _____No

_____ Initial

4. What is the VRM classification of the area? List Management Class _____ (I to IV).

_____ Map

Is a stipulation other than the standard one for esthetic values needed? _____Yes _____No (See MSO form 3100-47). If yes, attach map.

Stipulation _____

_____

(% of lease area)

Rationale attached _____Yes _____No

_____ Initial

5. All cultural resource values are covered by the standard stip on form MSO 3100-47.

_____ Map

Are there any significant known cultural resource sites? _____Yes _____No. If yes, describe briefly and map:

_____

_____

Recreation (continued)

_____ Initial

6. Is any portion of the lease in an area designated or under study for wilderness? _____Yes _____No. If yes, list area name _____. If under study, is approximate date of decision known?

_____ Map

_____Yes _____ (Date); _____ No

Is a stipulation other than the standard one for wilderness needed? _____Yes _____No

Stipulation _____

_____
(% of lease area)

Rationale attached _____Yes _____No

APPENDIX 3: STANDARD STIPULATIONS FOR OIL AND GAS LEASES

The BLM form for competitive oil and gas leases, form 3120-7, covers a wide range of standard stipulations in sections 2 through 9. Some subjects covered are bonding, rentals and royalties, inspections, and safety. Also covered is protection of the environment, surface resources, and improvements. Section 10 refers to the additional stipulations that may be attached as needed.

All BLM oil and gas leases issued in Montana now include the surface disturbance stipulations listed on form 3109-5 and the additional stipulations listed on form 3100-47. Stipulations on the second form cover cultural and paleontological resources, endangered or threatened species, esthetics, erosion control, and the potential for controlled or limited surface use.

The stipulation for controlled or limited surface use was added to form 3100-47 on April 1, 1981. This stipulation was developed in recognition of the fact that there will be no surface disturbance on most leases; therefore, a detailed, site-specific review is not needed at the time of lease issuance. This stipulation contains all the restrictions normally put on a lease and, in effect, binds the lessee to accept any site-specific restrictions imposed by the GS and the BLM when activities on the lease area are proposed. The use of this stipulation permits rapid agency response to lease applications and saves unnecessary field review and detailed analysis for most leases.

Other stipulation forms that may be used in special or unique situations are shown in Appendix 4, which also contains guidelines for completing the forms.

Form 3120–7
(February 1977)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Serial Number

OIL AND GAS LEASE
(COMPETITIVE PUBLIC DOMAIN LANDS)

THIS INDENTURE OF LEASE, entered into, as of , by and between

the UNITED STATES OF AMERICA, through the Bureau of Land Management, hereinafter called lessor, and

, C.

hereinafter called lessee, under, pursuant, and subject to the terms and provisions of the Act of February 25, 1920, (41 Stat. 437), as amended, (30 U.S.C. Sec. 181 *et seq*), hereinafter referred to as the Act, and to all reasonable regulations of the Secretary of the Interior now or hereafter in force when not inconsistent with any express and specific provisions herein, which are made a part hereof.

WITNESSETH:

Sec. 1. *Rights of lessee* – That lessor, in consideration or rents and royalties to be paid, and the conditions and covenants to be observed as herein set forth, does hereby grant and lease to lessee the exclusive right and privilege to drill for, mine, extract, remove, and dispose of all the oil and gas deposits, except helium gas, in or under the following-described tracts of land situated in the field:

containing acres, more or less, together with the right to construct and maintain thereupon all works, buildings, plants, waterways, roads, telegraph or telephone lines, pipelines, reservoirs, tanks, pumping stations, or other structures necessary to the full enjoyment thereof, for a period of five (5) years, and so long thereafter as oil or gas is produced in paying quantities; subject to any unit agreement heretofore or hereafter approved by the Secretary of the Interior, the provisions of said agreement to govern the lands subject thereto where inconsistencies with the terms of this lease occur.

Sec. 2. In consideration of the foregoing, lessee agrees:

(a) *Bonds* – (1) To maintain any bond furnished by the lessee as a condition for the issuance of this lease.

(2) To furnish prior to beginning of drilling operations and maintain at all times thereafter as required by lessor a bond in the penal sum of $10,000 with approved corporate surety, or with deposit of United States bonds as surety therefor, conditioned upon compliance with the terms of this lease, unless a bond in that amount is already being maintained or unless such a bond furnished by an operator of the lease is accepted, or unless a bond has been filed under 43 CFR 3104 applicable to this lease.

(b) *Cooperative or unit plan* – Within thirty (30) days of demand, or, if the leased land is committed to an approved unit or cooperative plan and such plan is terminated prior to the expiration of this lease, within thirty (30) days of demand made thereafter, to subscribe to and to operate under such reasonable cooperative or unit plan for the development and operation of the area, field, or pool, or part thereof, embracing the lands included herein as the Secretary of the Interior may then determine to be practicable and necessary or advisable, which plan shall adequately protect the rights of all parties in interest, including the United States.

(c) *Wells* – (1) To drill and produce all wells necessary to protect the leased land from drainage by wells on lands not the property of lessor, or lands of the United States leased at a lower royalty rate, or as to which the royalties and rentals are paid into different funds than are those of this lease; or in lieu of any part of such drilling and production, with the consent of the Director of the Geological Survey, to compensate lessor, in full, each month for the estimated loss of royalty through drainage in the amount determined by said Director.

(2) At the election of lessee, to drill and produce other wells in conformity with any system of well spacing or production allotments affecting the field or area in which the leased lands are situated, which is authorized and sanctioned by applicable law or by the Secretary of the Interior.

(3) Promptly after due notice, in writing, to drill and produce such other wells as the Secretary of the Interior may reasonably require in order that the leased premises may be properly and timely developed and produced in accordance with good operating practice.

(d) *Rentals and royalties* – To pay rentals and royalties in amount or value of production removed or sold from the leased lands as set forth in the rental and royalty schedule attached to and made a part hereof.

(1) It is expressly agreed that the Secretary of the Interior may establish reasonable minimum values for purposes of computing royalty on any or all oil, gas, natural gasoline, and other products obtained from gas, due consideration being given to the highest price paid for a part or for a majority of production of like quality in the same field, to the price received by lessee, to posted prices, and to other relevant matters and, whenever appropriate, after notice and opportunity to be heard.

(3) When paid in value, such royalties on production shall be due and payable monthly on the last day of the month next following the month in which produced. When paid in amount of production, such royalty products shall be delivered in merchantable condition on the premises where produced without cost to lessor, unless otherwise agreed to by the parties hereto, at such times and in such tanks provided by lessee as reasonably may be required by lessor, but in no case shall lessee be required to hold such royalty oil or other products in storage beyond the last day of the month next following the month in which produced nor be responsible or held liable for the loss or destruction of royalty oil or other products in storage from causes over which he has no control.

(4) Rentals or minimum royalties may be waived, suspended, or reduced; and royalties on the entire leasehold or any portion thereof segregated for royalty purpose may be reduced if the Secretary of the Interior finds that, for the purpose of encouraging the greatest ultimate recovery of oil or gas and in the interest of conservation of natural resources, it is necessary, in his judgment, to do so in order to promote development, or because the lease cannot be successfully operated under the terms fixed herein.

(e) *Payments* – Unless otherwise directed by the Secretary of the Interior, to make rental, royalty, or other payments to lessor, to the order of the Bureau of Land Management at the places mentioned in the regulation 43 CFR 3103.1–2. If there is no well on the leased lands capable of producing oil or gas in paying quantities, the failure to pay rental on or before the anniversary date shall automatically terminate the lease by operation of law. However, if the time for payment falls on a day in which the proper BLM office to receive payment is closed, payment shall be deemed timely if made on the next official working day.

(f) *Contracts for disposal of products* – To file with the Oil and Gas Supervisor of the Geological Survey not later than thirty (30) days after the effective date thereof any contract or evidence of other arrangement for the sale or disposal of oil, gas, natural gasoline, and other products of the leased land: *Provided*, That nothing in any such contract or other arrangement shall be construed as modifying any of the provisions of this lease, including, but not limited to, provisions relating to gas waste, taking royalty in kind, and the method of computing royalties due as based on a minimum valuation and in accordance with the Oil and Gas Operating Regulations.

(g) *Statements, plats, and reports* – At such times and in such form as lessor may prescribe, to furnish detailed statements showing the amounts and quality of all products removed and sold from the lease, the proceeds therefrom, and the amount used for production purposes or unavoidably lost; a plat showing development work and improvements on the leased lands; and a report with respect to stockholders, investments, depreciation, and costs.

(h) *Well records* – To keep a daily drilling record, a log, and complete information on all well surveys and tests in form acceptable to or prescribed by lessor of all wells drilled on the leased lands, and an acceptable record of all subsurface investigations affecting said lands, and to furnish them, or copies thereof, to lessor when required. All information obtained under this paragraph, upon request of lessee, shall not be open to inspection by the public until the expiration of the lease.

(i) *Inspection* – To keep open at all reasonable times for the inspection of any duly authorized officer of the Department, the leased premises and all wells, improvements, machinery, and fixtures thereon and all books, accounts, maps and records relative to operations and surveys or investigations on the leased lands or under the lease. All information obtained pursuant to any such inspection, upon request of lessee, shall not be open to inspection by the public until the expiration of the lease.

(j) *Diligence, prevention of waste, health and safety of workmen* – To exercise reasonable diligence in drilling and producing the wells herein provided for unless consent to suspend operations temporarily is granted by lessor; to carry on all operations in accordance with approved methods and practices as provided in the Oil and Gas Operating Regulations, having due regard for the prevention of waste of oil or gas or damage to deposits or formations containing oil, gas, or water or to coal measures or other mineral deposits, for conservation of gas energy, for the preservation and conservation of the property for future productive operations and for the health and safety of workmen and employees; to plug properly and effectively all wells drilled in accordance with the provisions of this lease or of any prior lease or permit upon which the right to this lease was predicated before abandoning the same; to carry out at expense of lessee all reasonable orders of lessor relative to the matters in this paragraph, and that on failure of lessee so to do lessor shall have the right to enter on the property and to accomplish the purpose of such orders at lessee's cost: *Provided*, That lessee shall not be held responsible for delays or casualties occasioned by causes beyond lessee's control.

(k) *Taxes and wages, freedom of purchase* – To pay when due, all taxes lawfully assessed and levied under the laws of the State or the United States upon improvements, oil and gas produced from the lands hereunder, or other rights, property or assets of lessee; to accord all workmen and employees complete freedom of purchase, and to pay all wages due workmen and employees at least twice each month in the lawful money of the United States.

(l) *Equal Opportunity Clause* – The lessee agrees that, during the performance of this lease,

(1) The lessee will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin. The lessee will take affirmative action to ensure that applicants, are employed, and that employees are treated during employment, without regard to their race, color, religion, sex or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The lessee agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the lessor setting forth the provisions of this Equal Opportunity Clause.

(2) The lessee will, in all solicitations or advertisements for employees placed by or on behalf of the lessee, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.

(3) The lessee will send to each labor union or representative of workers with which lessee has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the lessor, advising the labor union or workers' representative of the lessee's commitments under this Equal Opportunity Clause, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The lessee will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, as amended, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the lessee's noncompliance with the Equal Opportunity Clause of this lease or with any of said rules, regulations, or orders, this lease may be canceled, terminated or suspended in whole or in part and the lessee may be declared ineligible for further Federal Government contracts or leases in accordance with the procedures authorized in Executive Order No. 11246 of September 24, 1965, as amended, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, as amended, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The lessee will include the provisions of Paragraphs (1) through (7) of this subsection 2(l) in every contract, subcontract, or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, as amended, so that such provisions will be binding upon each contractor, subcontractor, or vendor. The lessee will take such action with respect to any contract, subcontract, or purchase order as the Secretary of the Interior may direct as a means of enforcing such provisions including sanctions for noncompliance; *Provided, however*, that in the event the lessee becomes involved in, or is threatened with, litigation with a contractor, subcontractor, or vendor as a result of such direction by the Secretary of the Interior, the lessee may request the United States to enter into such litigation to protect the interests of the United States.

(m) *Certification of nonsegregated facilities* – By entering into this lease, the lessee certifies that lessee does not and will not maintain or provide for lessee's employees any segregated facilities at any of lessee's establishments, and that lessee does not and will not permit lessee's employees to perform their services at any location, under lessee's con-

trol, where segregated facilities are maintained. The lessee agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this lease. As used in this certification, the term "segregated facilities" means, but is not limited to, any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise. Lessee further agrees that (except where lessee has obtained identical certifications from proposed contractors and subcontractors for specific time periods) lessee will obtain identical certifications from proposed contractors and subcontractors prior to the award of contracts or subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause, that lessee will retain such certifications in lessee's files; and that lessee will forward the following notice to such contractors and subcontractors (except where the proposed contractor or subcontractor has submitted identical certifications for specific time periods).

Notice to prospective contractors and subcontractors of requirement for certification of nonsegregated facilities – A Certification of Nonsegregated Facilities, as required by the May 9, 1967 order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a contract or subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity Clause. The certification may be submitted either for each contract and subcontract or for all contracts and subcontracts during a period (i.e., quarterly, semiannually, or annually).

(n) *Assignment of oil and gas lease or interest therein* – As required by applicable law, to file for approval by lessor any instrument of transfer made of this lease or any interest therein, including assignments of record title, operating agreements and subleases, working or royalty interests, within ninety (90) days from date of final execution thereof.

(o) *Pipelines to purchase or convey at reasonable rates and without discrimination* – If owner, or operator, or owner of a controlling interest in any pipeline or of any company operating the same which may be operated accessible to the oil or gas derived from lands under this lease, to accept and convey and, if a purchaser of such products, to purchase at reasonable rates and without discrimination the oil or gas of the Government or of any citizen or company not the owner of any pipeline, operating a lease or purchasing or selling oil, gas, natural gasoline, or other products under the provisions of the Act of August 7, 1947 (61 Stat. 913, 30 U.S.C. 351).

(p) *Lands patented with oil and gas deposits reserved to the United States* – To comply with all statutory requirements and regulations thereunder, if the lands embraced herein have been or shall hereafter be disposed of under the laws reserving to the United States the deposits of oil and gas therein, subject to such conditions as are or may hereafter be provided by the laws reserving such oil or gas.

(q) *Reserved or segregated lands* – If any of the land included in this lease is embraced in a reservation or segregated for any particular purpose, to conduct operations thereunder in conformity with such requirements as may be made by the Director, Bureau of Land Management, for the protection and use of the land for the purpose for which it was reserved or segregated, so far as may be consistent with the use of the land for the purpose of this lease, which latter shall be regarded as the dominant use unless otherwise provided herein or separately stipulated.

(r) *Protection of the environment including the surface, other resources and improvements* – In accordance with the directives contained in the National Environmental Policy Act (83 Stat. 852, 42 U.S.C. 4321–4347), the requirements of other environmental legislation, the oil and gas leasing regulations (43 CFR 3100) and the Oil and Gas Operating Regulations (30 CFR 221).

(1) *General* – Lessee shall take such steps as required by the drilling permit, the attached stipulations, or the authorized officer to prevent activities or operations on the leased lands from: (i) causing or contributing to soil erosion or damage to crops or other vegetative cover on Federal or non-Federal lands in the vicinity; (ii) polluting soil, air, or water; (iii) creating hazards to wildlife or depriving them of the use of the natural elements of their habitat; (iv) disturbing the surface or damaging areas of scenic value or natural beauty; (v) damaging or removing improvements owned by the United States or other parties; or (vi) destroying, damaging, or removing fossils, historic or removing fossils, historic or prehistoric ruins or artifacts. Lessee shall, prior to the termination of bond liability or at any other time when required and in the manner directed by lessor, reclaim all land the surface of which has been disturbed, dispose of all debris or solid waste, repair the offsite and onsite damage caused by lessee's activity or activities incidental thereto, restore access roads or trails to their former condition and remove structures. Lessor may prescribe, by stipulations to be subsequently included in this lease or through the authorized officer, the steps to be taken by lessee to protect or restore the environment both on and off the lands, and improvements thereon whether or not the improvements are owned by the United States.

(2) *Use of other resources* – Timber, mineral materials, and water from public water reserves or water developed by the Bureau of Land Management or its lessees, licensees, or permittees, except water rights established under State law acquired by such lessees, licensees, or permittees may be used only with advanced authorization from and on terms and conditions imposed by the authorized officer.

(3) *Antiquities and objects of historic value*

(i) Lessee shall immediately bring to the attention of the authorized officer any and all American antiquities or other objects of historic or scientific interest including, but not limited to, historic or prehistoric ruins, fossils, or artifacts discovered as a result of operations under this lease, and to leave such item(s) or condition(s) intact. Failure to comply with any of the terms and conditions imposed by the authorized officer with regard to the preservation of antiquities shall constitute a violation of the Antiquities Act (16 U.S.C. 431–433).

(ii) If the authorized officer determines that archaeological values exist or may exist on the lands within the lease and that they might be impaired by oil and gas operations, lessee will engage a recognized authority on archaeology, acceptable to the Bureau of Land Management, to survey and salvage, in advance of any operations, such values on the lands involved. The responsibility for and cost of this survey and salvage will be that of lessee.

(4) *Pollution Control* – Lessee agrees that this lease is subject to all relevant pollution control legislation at the Federal, State, or local level. Such legislation includes, but is not limited to the Clean Air Act, as amended (77 Stat. 392, 42 U.S.C. 1857, *et seq.*), the Refuse Act of 1899 (30 Stat. 1152, 33 U.S.C. 407–409), the Federal Water Pollution Control Act (62 Stat. 1155, 33 U.S.C. 1151–1161).

(5) *Stipulations* – To comply with stipulations attached hereto which are made a part of the lease or the approved *Application for Permit to Drill*.

(s) *Overriding royalties* – Not to create overriding royalties in excess of five percent except as otherwise authorized by the regulations.

(t) *Deliver premises in case of forfeiture* – To deliver up to lessor in good order and condition the land leased including all improvements which are necessary for the preservation of producing wells.

Sec. 3. The lessor reserves:

(a) *Easements and rights-of-way* – The right to permit for joint or several use easements or rights-of-way, including easements in tunnels upon, through, or in the lands leased, occupied, or used as may be necessary or appropriate to the working of the same or of other lands containing the deposits described in the Act, and the treatment and shipment of products thereof by or under authority of the Government, its lessees or permittees, and for other public purposes.

(b) *Disposition of surface* – The right to lease, sell, or otherwise dispose of the surface of the leased lands under existing law or laws hereafter enacted, insofar as said surface is unnecessary for the use of lessee in the extraction and removal of the oil and gas therein, or to dispose of any resource in such lands which will not unreasonably interfere with operations under this lease.

(c) *Monopoly and fair prices* – Full power and authority to promulgate and enforce all orders necessary to assure the sale of the production of the leased lands to the United States and to the public at reasonable prices, to protect the interests of the United States, to prevent monopoly, and to safeguard the public welfare.

(d) *Helium* – The ownership of helium and the right to extract or have extracted from all gas produced under this lease, subject to such rules and regulations as shall be prescribed by the Secretary of the Interior. If lessor elects to take the helium, lessee shall deliver all or any portion of gas containing the same to lessor, in the manner required by lessor, at any point on the leased premises or, if the area is served at the time of production by a gas-gathering system owned or operated by lessee, at any point in that system specified by lessor, for extraction of the helium by such means as lessor may provide. The residue shall be returned to lessee, with no substantial delay in the delivery of the gas produced from the well to owner or purchaser thereof. Save for the value of the helium extracted, lessee shall not suffer a diminution of the value of the gas produced from the well, or loss otherwise, including any expense caused solely by the requirement of the delivery of the gas to permit the extraction of helium, for which he is not reasonably compensated. Lessor

reserves the right to erect, maintain and operate any and all reduction works necessary for extraction of helium on the leased premises. Lessee further agrees to include in any contract of sale of gas from the lands subject to this lease provisions setting forth that lessor owns, and reserves the right to extract or have extracted, any helium in the gas sold, and that lessor may take the gas from a pipeline carrier or any other gas-gathering system and extract the helium and return the gas to owner thereof, without delay other than that caused by the extraction process; save for the value of the helium, owner shall not suffer any diminution of the value of the gas from which helium has been extracted, or any other loss arising from the extraction of helium, including any expense caused solely by the requirement of the delivery of the gas to permit the extraction of helium, for which he is not reasonably compensated. It is further agreed that any rights reserved vested in lessor under this paragraph shall also run to any agent or assignee of lessor or any purchaser of the rights of lessor.

(e) *Taking of royalties* – All rights pursuant to Sec. 36 of the Act, to take royalties in amount or in value of production.

(f) *Casing* – All rights pursuant to Sec. 40 of the Act to purchase casing and lease or operate valuable water wells.

Sec. 4. *Drilling and producing restrictions* – It is agreed that the rate of prospecting and developing and the quantity and rate of production from the lands covered by this lease shall be subject to control in the public interest by the Secretary of the Interior, and in the exercise of his judgment the Secretary may take into consideration, among other things, Federal and State laws, and regulations issued thereunder, or lawful agreements among operators regulating either drilling or production, or both. After unitization, the Secretary of the Interior, or any person, committee, or State or Federal officer or agency so authorized in the unit plan, may alter or modify, from time to time, the rate of prospecting and development and the quantity and rate of production from the lands covered by this lease.

Sec. 5. *Surrender and termination of lease* – Lessee may surrender this lease or any legal subdivision thereof by filing in the proper BLM office, a written relinquishment, in *triplicate*, which shall be effective as of the date of filing subject to the continued obligation of lessee and his surety to make payment of all accrued rentals and royalties and to place all wells on the land to be relinquished in condition for suspension or abandonment in accordance with the applicable lease terms and regulations.

Sec. 6. *Purchase of materials, etc., on termination of lease* – Upon expiration of the lease, or the earlier termination thereof pursuant to Sec. 5 above, lessee shall have the privilege at any time within a period of ninety (90) days thereafter of removing from the premises all machinery, equipment, tools, and materials other than improvements needed for producing wells. Any materials, tools, appliances, machinery, structures, and equipment subject to removal as above provided, which are allowed to remain on the leased lands shall become the property of lessor on expiration of the 90-day period or such extension thereof as may be granted because of adverse climatic conditions throughout said period: *Provided, that* lessee shall remove any or all such property where so directed by lessor.

Sec. 7. *Proceedings in case of default* – If lessee shall not comply with any of the provisions of the Act or the regulations thereunder or of this lease, or shall make default in the performance or observance of any of the terms hereof this lease may be canceled or terminated in accordance with Sec. 31 of the Act. This provision shall not be construed to prevent the exercise by lessor of any legal or equitable remedy which lessor might otherwise have. Upon cancellation or termination of this lease, any casing, material, or equipment determined by the lessor to be necessary for use in plugging or preserving any well drilled on the leased land shall become the property of lessor. A waiver of any particular cause of cancellation or termination shall not prevent the cancellation or termination of this lease for any other cause of cancellation or termination, or for the same cause occurring at any other time.

Sec. 8. *Heirs and successors in interest* – It is further agreed that each obligation hereunder shall extend to and be binding upon, and every benefit hereof shall inure to, the heirs, executors, administrators, successors, or assigns of the respective parties hereto.

Sec. 9. *Unlawful interest* – It is also further agreed that no Member of, or Delegate to, Congress, or Resident Commissioner, after his election or appointment, or either before or after he has qualified and during his continuance in office, and that no officer, agent, or employee of the Department of the Interior, except as provided in 43 CFR 7.4(a)(1), shall be admitted to any share or part in this lease or derive any benefit that may arise therefrom, and the provisions of Sec. 3741 of the Revised Statutes of the United States, (41 U.S.C. Sec. 22) as amended, and Secs. 431, 432, and 433, Title 18 U.S.C., relating to contracts, enter into and form a part of this lease so far as the same may be applicable.

Sec. 10. *Stipulations* – ☐ Stipulations are attached hereto and made a part hereof. The attached stipulations appear as consecutively numbered pages commencing with page 1 hereafter. ☐ Stipulations are *not* attached.

THE UNITED STATES OF AMERICA

By _____
(Authorized Officer)

_____
(Signature of Lessee)

_____
(Signature of Lessee)

_____
(Title)

_____
(Date)

GPO 839-217

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

SURFACE DISTURBANCE STIPULATIONS

Area Oil and Gas Supervisor or
District Engineer *(Address, include zip code)*

Management Agency *(name)*

Address *(include zip code)*

1. Notwithstanding any provision of this lease to the contrary, any drilling, construction, or other operation on the leased lands that will disturb the surface thereof or otherwise affect the environment, hereinafter called "surface disturbing operation," conducted by lessee shall be subject, as set forth in this stipulation, to prior approval of such operation by the Area Oil and Gas Supervisor in consultation with appropriate surface management agency and to such reasonable conditions, not inconsistent with the purposes for which this lease is issued, as the Supervisor may require to protect the surface of the leased lands and the environment.

2. Prior to entry upon the land or the disturbance of the surface thereof for drilling or other purposes, lessee shall submit for approval two (2) copies of a map and explanation of the nature of the anticipated activity and surface disturbance to the District Engineer or Area Oil and Gas Supervisor, as appropriate, and will also furnish the appropriate surface management agency named above, with a copy of such map and explanation.

An environmental analysis will be made by the Geological Survey in consultation with the appropriate surface management agency for the purpose of assuring proper protection of the surface, the natural resources, the environment, existing improvements, and for assuring timely reclamation of disturbed lands.

3. Upon completion of said environmental analysis, the District Engineer or Area Oil and Gas Supervisor, as appropriate, shall notify lessee of the conditions, if any, to which the proposed surface disturbing operations will be subject.

Said conditions may relate to any of the following:

(a) Location of drilling or other exploratory or developmental operations or the manner in which they are to be conducted;

(b) Types of vehicles that may be used and areas in which they may be used; and

(c) Manner or location in which improvements such as roads, buildings, pipelines, or other improvements are to be constructed.

Form 3109-5 (August 1973)

GPO 849-258

UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Land Management

_____
(Serial Number)

OIL AND GAS LEASE STIPULATIONS

CULTURAL AND PALEONTOLOGICAL RESOURCES — The Federal surface management agency is responsible for assuring that the leased lands are examined to determine if cultural resources are present and to specify mitigation measures. Prior to undertaking any surface-disturbing activities on the lands covered by this lease, the lessee or operator, unless notified to the contrary by the authorized officer of the surface management agency, shall:

1. Engage the services of a qualified cultural resource specialist acceptable to the Federal surface management agency to conduct an intensive inventory for evidence of cultural resource values;

2. Submit a report acceptable to the authorized officer of the surface management agency and the District Engineer, Geological Survey; and

3. Implement mitigation measures required by the surface management agency to preserve or avoid destruction of cultural resource values. Mitigation may include relocation of proposed facilities, testing and salvage or other protective measures. All costs of the inventory and mitigation will be borne by the lessee or operator, and all data and materials salvaged will remain under the jurisdiction of the U.S. Government as appropriate.

The lessee or operator shall immediately bring to the attention of the District Engineer, Geological Survey, or the authorized officer of the Federal surface management agency any cultural or paleontological resources or any other objects of scientific interest discovered as a result of surface operations under this lease, and shall leave such discoveries intact until directed to proceed by the District Engineer, Geological Survey.

ENDANGERED OR THREATENED SPECIES — The Federal surface management agency is responsible for assuring that the leased land is examined prior to undertaking any surface-disturbing activities to determine effects upon any plant or animal species, listed or proposed for listing as endangered or threatened, or their habitats. The findings of this examination may result in some restrictions to the operator's plans or even disallow use and occupancy that would be in violation of the Endangered Species Act of 1973 by detrimentally affecting endangered or threatened species or their habitats.

The lessee/operator may, unless notified by the authorized officer of the surface management agency that the examination is not necessary, conduct the examination on the leased lands at his discretion and cost. This examination must be done by or under the supervision of a qualified resources specialist approved by the surface management agency. An acceptable report must be provided to the surface management agency identifying the anticipated effects of a proposed action on endangered or threatened species or their habitats.

ESTHETICS — To maintain esthetic values, all surface-disturbing activities, semipermanent and permanent facilities may require special design including location, painting and camouflage to blend with the natural surroundings and meet the intent of the visual quality objectives of the Federal surface management agency.

EROSION CONTROL — Surface disturbing activities may be prohibited during muddy and/or wet soil periods. This limitation does not apply to operation and maintenance of producing wells using authorized roads.

CONTROLLED OR LIMITED SURFACE USE STIPULATION — This stipulation may be modified by special stipulations which are hereto attached or when specifically approved in writing by the District Engineer, Geological Survey, with concurrence of the Federal surface management agency. Distances and/or time periods may be made less restrictive depending on the actual onground conditions. The prospective lessee should contact the Federal surface management agency for more specific locations and information regarding the restrictive nature of this stipulation.

The lessee/operator is given notice that the lands within this lease may include special areas and that such areas may contain special values, may be needed for special purposes, or may require special attention to prevent damage to surface and/or other resources. Possible special areas are identified below. Any surface use or occupancy within such special areas will be strictly controlled or, **if absolutely necessary**, excluded. Use or occupancy will be restricted only when the Geological Survey and/or the surface management agency demonstrates the restriction necessary for the protection of such special areas and existing or planned uses. Appropriate modifications to imposed restrictions will be made for the maintenance and operations of producing oil and gas wells.

After the Federal surface management agency has been advised of specific proposed surface use or occupancy on the leased lands, and on request of the lessee/operator, the Agency will furnish further data on any special areas which may include:

100 feet from the edge of the rights-of-way from highways, designated county roads and appropriate federally-owned or controlled roads and recreation trails.

500 feet, or when necessary, within the 25-year flood plain from reservoirs, lakes, and ponds and intermittent, ephemeral or small perennial streams; 1,000 feet, or when necessary, within the 100-year flood plain from larger perennial streams, rivers, and domestic water supplies.

500 feet from grouse strutting grounds. Special care to avoid nesting areas associated with strutting grounds will be necessary during the period from March 1 to June 30. One-fourth mile from identified essential habitat of state and federal sensitive species. Crucial wildlife winter ranges during the period from December 1 to May 15, and in elk calving areas, during the period from May 1 to June 30.

300 feet from occupied buildings, developed recreational areas, undeveloped recreational areas receiving concentrated public use and sites eligible for or designated as National Register sites.

Seasonal road closures, roads for special uses, specified roads during heavy traffic periods and on areas having restrictive off-road vehicle designations.

On slopes over 30 percent, or 20 percent on extremely erodable or slumping soils.

Date

Lessee's Signature

MSO 3100-47c (April 1981)

APPENDIX 4: SPECIAL STIPULATIONS FOR OIL AND GAS LEASES

This appendix contains samples of forms for special stipulations for BLM oil and gas leases. These forms have been approved for use in Montana.

Special stipulations may be required to mitigate unique site-specific impacts. They must be agreed to by the BLM and the GS before the lessee is required to accept them as a condition of the lease. Form 3100-51, Wilderness Protection Stipulation, is used for all leases that include lands being studied for their wilderness potential. Forms 3100-45, -49, and -50 can be completed as indicated in the guidelines that accompany each form.

FORM ATTACHED TO LEASES FOR LANDS UNDER WILDERNESS REVIEW

United States Department of the Interior
Bureau of Land Management
Montana State Office

WILDERNESS PROTECTION STIPULATION _____ (Serial Number)

By accepting this lease, the lessee acknowledges that the lands contained in this lease are being inventoried or evaluated for their wilderness potential by the Bureau of Land Management (BLM) under section 603 of the Federal Land Policy and Management Act of 1976, 90 Stat. 2743 (43 USC Sec. 1782), and that exploration or production activities which are not in conformity with section 603 may never be permitted.

☐ All lands within the lease (% of lease affected)

☐ Part of the lands within the lease described as follows:

Expenditures in leases on which exploration drilling or production are not allowed will create no additional rights in the lease, and such leases will expire in accordance with law.

Activities will be permitted under the lease so long as BLM determines they will not impair wilderness suitability. This will be the case either until the BLM wilderness inventory process has resulted in a final wilderness inventory decision that an area lacks wilderness characteristics, or in the case of a wilderness study area until Congress has decided not to designate the lands included within this lease as wilderness. Activities will be considered nonimpairing if the BLM determines that they meet each of the following three criteria:

(a) It is temporary. This means that the use or activity may continue until the time when it must be terminated in order to meet the reclamation requirement of paragraphs (b) and (c) below. A temporary use that creates no new surface disturbance may continue unless Congress designates the area as wilderness, so long as it can easily and immediately be terminated at that time, if necessary to management of the area as wilderness.

(b) Any temporary impacts caused by the activity must, at a minimum, be capable of being reclaimed to a condition of being substantially unnoticeable in the wilderness study area (or inventory unit) as a whole by the time the Secretary of the Interior is scheduled to send his recommendations on that area to the President, and the operator will be required to reclaim the impacts to that standard by that date. If the wilderness study is postponed, the reclamation deadline will be extended accordingly. If the wilderness study is accelerated, the reclamation deadline will not be changed. A full schedule of wilderness studies will be developed by the Department upon completion of the intensive wilderness inventory. In the meantime, in areas not yet scheduled for wilderness study, the reclamation will be scheduled for completion within 4 years after approval of the activity. (Obviously, if and when the Interim Management Policy ceases to apply to an inventory unit dropped from wilderness review following a final wilderness inventory decision of the BLM State Director, the reclamation deadline previously specified will cease to apply.) The Secretary's schedule for transmitting his recommendations to the President will not be changed as a result of any unexpected inability to complete the reclamation by the specified date, and such inability will not constrain the Secretary's recommendation with respect to the area's suitability or nonsuitability for preservation as wilderness.

The reclamation will, to the extent practicable, be done while the activity is in progress. Reclamation will include the complete recontouring of all cuts and fills to blend with the natural topography, the replacement of topsoil, and the restoration of plant cover at least to the point where natural succession is occurring. Plant cover wil be restored by means of reseeding or replanting, using species previously occurring in the area. If necessary, irrigation will be required. The reclamation schedule will be based on conservative assumptions with regard to growing conditions, so as to ensure that the reclamation will be complete, and the impacts will be substantially unnoticeable in the area as a whole, by the time the Secretary is scheduled to send his recommendations to the President. ("Substantially unnoticeable" is defined in Appendix F of the **Interim Management Policy and Guidelines for Lands under Wilderness Review**.)

(c) When the activity is terminated, and after any needed reclamation is complete, the area's wilderness values must not have been degraded so far, compared with the area's values for other purposes, as to significantly constrain the Secretary's recommendation with respect to the area's suitability or nonsuitability for preservation as wilderness. The wilderness values to be considered are those mentioned in section 2(c) of the Wilderness Act, including naturalness, outstanding opportunities for solitude or for primitive and unconfined recreation, and ecological, geological or other features of scientific, educational, scenic, or historical value. If all or any part of the area included within the leasehold estate is formally designated by Congress as wilderness, exploration and development operations taking place or to take place on that part of the lease will remain subject to the requirements of this stipulation, except as modified by the Act of Congress designating the land as wilderness. If Congress does not specify in such act how existing leases like this one will be managed, then the provisions of the Wilderness Act of 1964 will apply, as implemented by rules and regulations promulgated by the Department of the Interior.

If it is found that the area does not have wilderness characteristics or is not suitable to be designated a part of the National Wilderness Preservation system, development and/or surface occupancy will be subject to the remaining lease terms and the special stipulations.

_____ Date

_____ Lessee's Signature

MSO 3100-51 (May 1980)

SAMPLE OF FORM FOR SPECIAL STIPULATIONS

Letters and numbers refer to guidelines on opposite page.

UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Land Management

(OG SIM Serial No.) _____ (Serial Number) _____

SPECIAL OIL AND GAS LEASE STIPULATIONS

The following special stipulations may be modified when specifically approved in writing by the District Engineer, Geological Survey with concurrence of the Federal surface management agency.

(Only stipulations checked apply to this lease.) (Approximate % of lease affected by stipulation.)

A ( ) No occupancy or other activity on the surface of the following-described land is allowed under this lease: (1)

2

Reasons for this restriction are:

3

B (4) No occupancy or other surface disturbance will be allowed within 5 feet ( )
of the 6

C ( ) No drilling or storage facilities will be allowed within _____ feet ( )
of _____
located in _____

D ( ) No occupancy or other surface disturbance will be allowed on slopes in excess of ( )
7 percent.

E ( ) In order to _____ ( )
8
exploration, drilling, and other development activity will be allowed only during the period from 9 to 9.
This limitation does not apply to maintenance and operation of producing wells and facilities. Lands within the leased area to which this stipulation applies are described as follows:

10

F ( ) The 11 will not be used as ( )
an access road for activities on this lease except as follows:

12

Date _____ Lessee's Signature _____

MSO 3100-4 (Jan. 1981)

GUIDELINES FOR COMPLETING FORM MSO 3100-45

A. The purpose of this stipulation is to prohibit surface occupancy of all types during the period that the lease is in effect.

1. Enter percentage of the total lease area affected by stipulation.

2. Enter proper legal description.

3. Enter the reason for restriction or, if space does not permit, refer to an attached reason or rationale.

General reasons for no occupancy:

Highly erosive soils, soils that may not be reclaimable, unstable soils and slopes

High use recreation areas

Crucial wildlife areas requiring yearlong protection

Areas designated closed to ORV use

Municipal watersheds

B. The purpose of this stipulation is to prevent damage to springs, streams, riparian zones, recreation sites, canals, etc. In addition, this stipulation provides an offset or buffer zone for recreation sites, roads, and private homes.

4. Enter stipulation number.

5. Enter setback distance.

6. Enter whatever it is to be set back from.

C. This stipulation is similar to "B" except that it allows for geophysical exploration.

D. Slope stipulation:

7. Enter 30%, the standard.

E. The purpose of this stipulation is to prohibit certain activities during periods when resource damage or use conflicts could occur.

8. Enter resource concern; for example, prevent soil compaction, protect seasonal wildlife habitat (winter range), protect calving/lambing area, avert recreation conflicts.

9. Enter time when restriction is NOT in effect (when development will be allowed).

10. Enter legal description.

F. The purpose of this stipulation is to restrict road use to prevent resource damage or to prevent road use conflicts.

11. Enter road or trail name or number.

12. Identify exceptions; e.g., one-way travel, light duty vehicles (3/4 ton or less), specified time periods.

SAMPLE OF FORM FOR RESTRICTING ACTIVITY DURING CERTAIN PERIODS

UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Land Management

(OG Sim Serial Number) _____ (Serial Number) _____

OIL AND GAS LEASE STIPULATIONS

(% of lease affected by stipulation)

(___) In order to ___1___, (___) exploration, drilling and other development activity and maintenance and operation of producing wells and facilities that requires on site access will be allowed only during the period from ___2___ to ___2___. Lands within the lease area to which this stipulation applies are described as follows:

3

Exceptions to this limitation in any year may be specifically authorized in writing by the District Engineer, Geological Survey (GS), with the concurrence of the District Manager, Bureau of Land Management (BLM).

_____ _____
Date Lessee's Signature

MSO 3100-49 (May 1978)

GUIDELINES FOR COMPLETION

The purpose of stipulations on this form is to restrict all kinds of activity during a critical use period.

1. Enter resource concern; for example, prevent soil compaction, protect wildlife habitat.
2. Enter time when restriction is NOT in effect (when development will be allowed).
3. Enter reasons; for example, critical wildlife habitat cannot tolerate activity.

This stipulation limits production by causing producing wells to be shut down for a particular time period; thus, it should be used only to protect very high resource values.

SAMPLE OF FORM FOR PROTECTING SOILS

UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Land Management

(OG Sim Serial Number) _____ (Serial Number) _____

OIL AND GAS LEASE STIPULATIONS

(% of lease affected by stipulation)

(___) In order to minimize watershed damage and protect fragile soils, surface disturbing activities will be allowed only during the period from 1 to 1. Lands within the leased area to which this stipulation applies are described as follows: (___)

2

Exceptions to this limitation in any year may be specifically authorized in writing by the District Engineer, Geological Survey (GS), with the concurrence of the District Manager, Bureau of Land Management (BLM).

Date _____ Lessee's Signature _____

MSO 3100-50 (May 1978)

GUIDELINES FOR COMPLETION

The purpose of this stipulation is to prevent rutting and compaction of compressible soils.

1. Enter the dates during which development can take place.
2. Enter the location(s) of the land affected.

APPENDIX 5: MONTANA BLM HISTORIC PRESERVATION POLICY

The following paragraphs outline the management policy that is followed by the BLM in Montana, North Dakota, and South Dakota for compliance with the regulations of 36 CFR 800.

APPLICATION

These regulations apply to any federal undertaking that might affect a cultural property. The definition of a "federal undertaking" is very broad—it includes all actions, activities, or programs and any type of assistance, support, or sanction of nonfederal undertakings. The procedures must be applied in time to be included in the preparation of environmental analysis reports or environmental impact statements, so that sufficient lead time is available for the consultation described below. In any case, these procedures must be completed before the BLM gives final approval or takes final action on an undertaking.

IDENTIFICATION OF CULTURAL PROPERTIES

For BLM-initiated actions, all cultural properties that would be affected must be identified. Before making general land use decisions (such as an oil and gas lease offering), at a minimum the BLM must consult the current listing of properties listed on and eligible for the National Register of Historic Places and the known properties identified by the district's existing data (Class I) inventory. (Inventory classes are defined in the *BLM Manual*, section 8111.) Before authorizing specific ground-disturbing actions under these land use decisions (for example, an application for permit to drill), the BLM must complete an intensive field inventory (Class III) over the area of impact.

For all other BLM-initiated ground-disturbing actions, whether they are covered by general land use decisions or not, the BLM must complete a Class III inventory over the area of impact before authorizing the action. The same general provisions apply to all actions not initiated by the BLM, but the applicant may be required to fund and contract the actual field work.

EVALUATION OF CULTURAL PROPERTIES

Once all cultural properties within the impact zone are identified, the BLM must apply the criteria for determining their eligibility for the National Register. After the criteria are applied to all cultural sites, the determinations of eligibility must be sent with documentation to the State Historic Preservation Officer (SHPO) as part of the consultation process described below.

CONSULTATION DURING IDENTIFICATION AND EVALUATION

The SHPO should be consulted as early as possible during the decision planning process. For large-scale projects or land use decisions, the BLM should write to the SHPO during the planning stage, requesting a list of all previously inventoried cultural properties, an evaluation of the quality of those inventories, and recommendations for further inventory needs, methods, and boundaries. The BLM should give the SHPO's recommendations serious consideration before conducting an inventory.

A Class III inventory will be done for the area of impact for all ground-disturbing actions. The inventory report, which will be a part of the consultation document, should be adequate to define the impact area and inventory methods and to evaluate sites for National Register eligibility. The BLM should send the inventory report and the site forms to the SHPO with the BLM's opinion on eligibility and, if properties eligible for the National Register are present, the effect of the action. If no properties are found or if properties are found but will be avoided, the BLM must obtain comment from the SHPO before authorizing the project.

If the BLM and the SHPO agree that no site meets the criteria for National Register eligibility, this agreement must be documented. The undertaking can then proceed without further review by the SHPO, the National Register, or the Advisory Council on Historic Preservation. If the BLM and the SHPO agree on the eligibility determination for all sites, documentation showing that they agree must be sent to the Secretary of the Interior for his formal determination of eligibility.

If the BLM and the SHPO disagree on eligibility, a request for determination of eligibility can be made directly to the Secretary of the Interior through the National Register. It is probable that the Secretary would request further information, and substantial delays in project clearance would result. If it appears that the BLM and the SHPO will disagree, the BLM should prepare more complete documentation on the BLM's opinion to aid the Secretary's decision.

DETERMINATION OF EFFECT

The BLM must determine the effect of any project on all properties listed on or eligible for the National Register. This determination must be made in consultation with the SHPO. If the BLM determines that there will be no effect, it must notify the SHPO of that decision. If the SHPO objects, the Advisory Council on Historic Preservation will be given an opportunity to comment. "Effect" is defined as any change that the undertaking would make in the integrity of location, design, setting, materials, workmanship, feeling, or association that contributes to the significance of properties listed on or eligible for the National Register.

If the BLM determines that an effect will occur, the criteria for determining adverse effect must be applied to the properties, again in consultation with the SHPO. The BLM can do this concurrently with the initial determination of effect by documenting the effects predicted to occur at the property. The determination may result in a decision that there will or will not be an adverse effect. A "no adverse effect" determination must be documented and sent with a data recovery plan (if applicable) to the SHPO, whose written opinion must be requested.

An "adverse effect" determination must be documented through preparation of a preliminary case report, which also must be sent to the SHPO for a written opinion. Adverse effects are effects that (1) destroy or alter the property, (2) isolate from or alter the property's surroundings, (3) introduce visual, audible, or atmospheric elements out of character with the property, (4) neglect the property to the point of determination or destruction, or (5) allow the property to pass from federal ownership without protective stipulations.

When effect has been documented, this documentation, along with the SHPO's written opinion, must be sent to the Advisory Council on Historic Preservation for comment. A determination of no adverse effect would allow the undertaking to proceed under the conditions of the "no adverse effect" documentation. A determination of adverse effect usually will require a memorandum of agreement written by the Advisory Council. Signatories to this memorandum should be the BLM, the Advisory Council, the SHPO, and, for actions not initiated by the BLM, the applicant. In most cases the major portions of the memorandum of agreement will consist of the preliminary case report developed by BLM staff.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1981 — 777-118/20 Region No. 8

BUTTE DISTRICT
OIL & GAS ENVIRONMENTAL ASSESSMENT
BUREAU OF LAND MANAGEMENT
U.S. DEPARTMENT OF THE INTERIOR

I 53.MB:B98

BLACKFEET INDIAN RESERVATION

FLATHEAD INDIAN RESERVATION

YELLOWSTONE NATIONAL PARK

NORTH

VISUAL RESOURCES

Class A Scenery — Highest Scenic Values

Class B Scenery — Medium Scenic Values

Class C Scenery — Low Scenic Values

District Office

Resource Area Office

District Boundary

Resource Area Boundary

Scale 1:1,000,000

0 5 10 15 20 25 30 35 40 45 50 55 60 65 miles
0 10 20 30 40 50 60 kilometers

SOURCE: Bureau of Land Management, U.S. Dept. of the Interior, 1981.

BUTTE DISTRICT
OIL & GAS ENVIRONMENTAL ASSESSMENT
BUREAU OF LAND MANAGEMENT
U.S. DEPARTMENT OF THE INTERIOR

HYDROLOGIC SENSITIVITY

Sensitive

Critically Sensitive

District Office

Resource Area Office

District Boundary

Resource Area Boundary

Scale 1:1,000,000

SOURCE: Bureau of Land Management, U.S. Dept. of the Interior, 1981.

BUTTE DISTRICT
OIL & GAS ENVIRONMENTAL ASSESSMENT
BUREAU OF LAND MANAGEMENT
U.S. DEPARTMENT OF THE INTERIOR

NORTH

LAND STATUS

- Bureau of Land Management
- Bureau of Indian Affairs
- Forest Service
- Fish and Wildlife Service
- National Park Service
- State

★ District Office
☆ Resource Area Office
District Boundary
Resource Area Boundary

Scale 1:1,000,000

0 5 10 15 20 25 30 35 40 45 50 55 60 65 miles
0 10 20 30 40 50 60 kilometers

SOURCE: Bureau of Land Management, U.S. Dept. of the Interior, 1981.

I 53.19/3:B98

BUTTE DISTRICT
OIL & GAS ENVIRONMENTAL ASSESSMENT
BUREAU OF LAND MANAGEMENT
U.S. DEPARTMENT OF THE INTERIOR

NORTHERN
ROCKY MOUNTAIN WOLF

Proposed Essential Habitat Boundary
(Bureau of Land Management Approximate)

Essential Habitat Boundary
(Forest Service)

District Office
District Boundary
Resource Area Office
Resource Area Boundary

Scale 1:1,000,000

0 5 10 15 20 25 30 35 40 45 50 55 60 65 miles
0 10 20 30 40 50 60 kilometers

SOURCE: Bureau of Land Management, U.S. Dept. of the Interior, 1980, and Forest Service, Dept. of Agriculture, 1980.

BUTTE DISTRICT
OIL & GAS ENVIRONMENTAL ASSESSMENT
BUREAU OF LAND MANAGEMENT
U.S. DEPARTMENT OF THE INTERIOR

BLACKFEET INDIAN RESERVATION

FLATHEAD INDIAN RESERVATION

GREAT FALLS

NORTH

SCALE

RANGE

GROUNDWATER

JEFFERSON

MEAGHER

MADISON

BEAVERHEAD

PARK

SILVER BOW

GRIZZLY BEAR

Grizzly Bear Distribution Occupied Habitat

Grizzly Bear Distribution Limits Unknown

★ District Office

☆ Resource Area Office

District Boundary

Resource Area Boundary

Scale 1:1,000,000

0 5 10 15 20 25 30 35 40 45 50 55 60 65 miles

0 10 20 30 40 50 60 kilometers

SOURCE: Game Management in Montana, Montana Dept. of Fish, Wildlife and Parks, 1971.

753.19/3:398

BUTTE DISTRICT
OIL & GAS ENVIRONMENTAL ASSESSMENT
BUREAU OF LAND MANAGEMENT
U.S. DEPARTMENT OF THE INTERIOR

Details Not Shown for this Area

BLACKFEET INDIAN RESERVATION

FLATHEAD INDIAN RESERVATION

GREAT FALLS

YELLOWSTONE NATIONAL PARK

NORTH

RECREATION

Wilderness Study Area, Instant Study Area or Appendix Units subject to Interim Management Plan.

Off Road Vehicle Designations
- Limited
- Closed

Developed Ski Areas

Travel Zone

Campgrounds
- Bureau of Land Management
- National Park Service
- Fish, Wildlife and Parks
- Forest Service
- Bureau of Reclamation
- Private
- Fish and Wildlife Service
- Highway Department

District Office

Resource Area Office

District Boundary

Resource Area Boundary

Scale 1:1,000,000

0 5 10 15 20 25 30 35 40 45 50 55 60 65 miles
0 10 20 30 40 50 60 kilometers

SOURCE: Bureau of Land Management, U.S. Dept. of the Interior, 1981.

I 53.19/3:B98

BUTTE DISTRICT
OIL & GAS ENVIRONMENTAL ASSESSMENT
BUREAU OF LAND MANAGEMENT
U.S. DEPARTMENT OF THE INTERIOR

BLACKFEET INDIAN RESERVATION

FLATHEAD INDIAN RESERVATION

GREAT FALLS

DEER LODGE

BUTTE

YELLOWSTONE NATIONAL PARK

NORTH

FISHERIES

Class I — Highest Value Fishery Resource
Class II — High Value Fishery Resource
Class III — Substantial Value Fishery Resource
Class IV — Moderate Value Fishery Resource
Class V — Limited Value Fishery Resource
Class VI — Not Classified

District Office
Resource Area Office
District Boundary
Resource Area Boundary

Scale 1:1,000,000

0 5 10 15 20 25 30 35 40 45 50 55 60 65 miles
0 10 20 30 40 50 60 kilometers

SOURCE: Bureau of Land Management, U.S. Dept. of the Interior, 1981, and Fish and Wildlife Service, U.S. Dept. of the Interior, 1980.